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Radiographic and ultrasonographic changes in calves affected with septic arthritis

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Abstract

Twelve clinical cases of septic arthritis in calves were divided into two groups of six animals each. Both the groups were treated using an intra-articular chitosan-based drug delivery system impregnated with ceftiofur sodium and honey. Radiographic and ultrasonographic evaluations were performed to assess changes associated with septic arthritis. The most common radiographic finding observed was soft tissue swelling along with widening of the joint space. Ultrasonographic examination of affected joints in both groups revealed hypoechoic areas indicative of joint effusion. Clinically, the calves presented with moderate to severe lameness at the time of presentation, which gradually improved to normal following the treatment. These clinical improvements were consistent with the radiographic and ultrasonographic evidence of healing observed during the study.

Keywords: Sepsis, arthritis, calves, radiography, ultrasonography

1. Introduction

The most common causes of culling in calves and the resulting economic losses are “septic arthritis and other joint diseases (Goodarzi *et al.*, 2015)^[1]. According to Dogan *et al.* (2016)^[2], radiography and ultrasonography can be effectively used to detect joint problems in calves. They also noted that although treatment is often challenging and time-consuming, it yields favorable outcomes when the disease involves only a single joint and is not associated with systemic disorders. Nouri *et al.* (2013)^[3] reported that radiographic examination of joints is a standard diagnostic procedure for evaluating joint diseases. Ultrasonography, on the other hand, serves as an important initial imaging modality with high sensitivity for detecting joint effusion in septic arthritis (Macrae and Scott, 1999^[4]; Heppelmann *et al.*, 2009^[5]; Basawaraj *et al.*, 2012^[6]; Kofler *et al.*, 2014^[7]). It also facilitates early detection and staging of septic joint disease (Kofler, 1996^[8]; Kofler, 1997^[9]; Nuss and Maierl, 2000^[10]). Similarly, Basawaraj *et al.* (2012)^[6] emphasized that ultrasonography is a highly sensitive and reliable initial imaging technique for diagnosing joint effusion in cases of septic arthritis”.

2. Materials and Methods

Clinical cases of calves diagnosed with septic arthritis (joint ill) and “presented to the Departments of Veterinary Surgery and Radiology at the Veterinary College, Hebbal, Bangalore, the College of Veterinary Science, Tirupati and the Veterinary Hospital, Visakhapatnam, were included in this study. A total of twelve calves were selected and divided into two groups of six animals each. Group I was treated with an intra-articular chitosan drug delivery system impregnated with ceftiofur sodium, while Group II received the same system impregnated with honey. Radiographic examinations of the affected joints were performed in anteroposterior (AP) and mediolateral (ML) views before treatment and on the 7th, 14th, 21st, and 28th days post-treatment, using standard radiographic exposure settings. Prior to ultrasonographic examination, the affected joints were thoroughly cleaned, shaved, and coupling gel was applied. Ultrasonographic scanning was carried out using an Esaote MyLab Vet (Model No. 7340) ultrasound machine equipped with a 7.5 MHz linear array probe. Each=

affected joint was examined in both transverse and longitudinal planes before treatment and on the 7th, 14th, 21st, and 28th days following treatment.”

3. Results

In the present study, radiographic examination of 14 affected joints in 12 calves diagnosed with septic arthritis revealed soft tissue swelling in 10 joints (83.3%), widened joint spaces in 6 joints (50%), and air pockets in 1 joint (8.33%). The primary radiographic abnormalities observed included soft tissue swelling, widening of the joint space, presence of air pockets, subchondral osteolysis, severe arthritic changes and displacement of the carpal bones. Among these, soft tissue swelling was the most frequently observed finding.

Subchondral osteolysis and severe arthritic changes were noted only in chronic cases. The various radiographic changes identified in all calves with septic arthritis are presented in Table 1 and illustrated in Figures 1 and 2.

Table 1: Various radiographic findings observed in all calves with septic arthritis

Sl. No.	Radiographic signs	No. of joints			
		Carpus	Tarsus	Fetlock	Total
1.	Soft tissue swelling	38	4	2	44
2.	Air spaces	5	1	-	6
3.	Widened joint space	7	2	-	9
4.	Subchondral osteolysis	6	-	-	6
5.	Severe arthritic changes	5	-	-	5

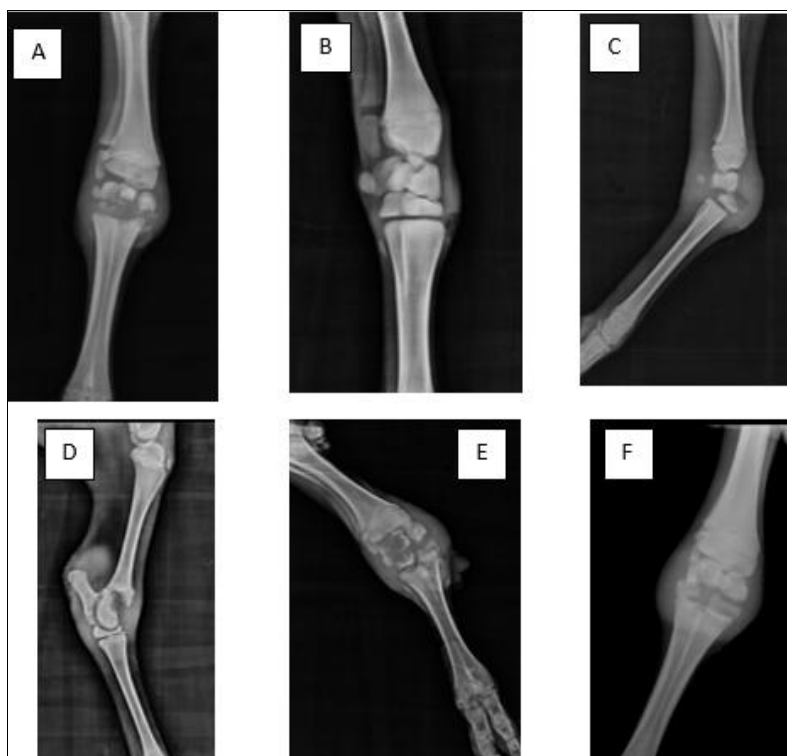


Fig 1: Skiagrams showing different radiographic findings in calves with septic arthritis were severe soft tissue swelling (A, C, D, E and F); widened joint space (B); osteolysis, severe arthritic changes (D, E and F) and displacement of carpal bones (A, C, E and F)



Fig 2: Skiagrams (ML view) showing gradual decrease in joint swelling from 0th day to 28th day in a calf with septic arthritis in left carpal joint in group II.

Ultrasonographic examination of the affected joints in calves with septic arthritis revealed both anechoic and hypoechoic areas. Joint space widening accompanied by joint effusion, appearing as hypoechoic regions, was observed in 9 cases. In acute cases with closed joints (3 cases), grey-colored echogenic material, identified as fibrin, was seen floating within the joint space upon manipulation. In contrast, chronic cases with closed joints showed uniform echogenicity within the joint cavity. The various ultrasonographic findings observed in all calves with septic arthritis are summarized in Table 2 and illustrated in Figures 3 and 4.

Table 2: Various ultrasonographic findings observed in all calves with septic arthritis.

Sl. No.	Ultrasonographic findings	No of joints
1	Joint effusion as hypoechoic areas	30
2	Grey coloured (echogenic) material (fibrin)-floating phenomenon	12
3	Uniform echogenic areas	6

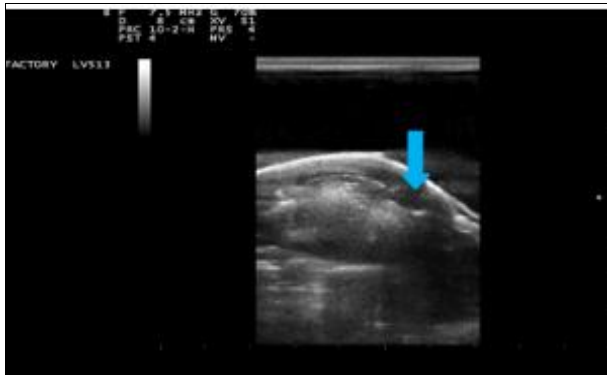


Fig 3: Joint effusion as hypoechoic area (arrow) in a calf with septic arthritis in right carpal joint (Group II)



Fig 4: Echogenic material (fibrin) floating in a joint (arrow) with septic arthritis in right carpal joint (Group I)

4. Discussion

In the present study, “radiographic examination of calves affected with septic arthritis predominantly revealed soft tissue swelling and widening of the joint space. These findings are consistent with the observations of Bennett and Taylor (1988) [11], Kofler (1996) [8], Jackson (1999) [12], Desrochers (2004) [13], Lugo and Gaughan (2006) [14] and Ramanathan (2007) [15]. Among the observed lesions, soft tissue swelling was the most frequent radiographic abnormality, indicating early inflammatory changes in and around the affected joints. As reported by Weaver (1997) [16], Madigan and House (2002) [17], and May (2005) [18], soft tissue swelling represents the earliest radiographic sign of joint infection, prior to any visible bony involvement. A gradual reduction in swelling was noted in both treatment groups following initiation of therapy, reflecting clinical improvement. Air pockets were identified in two cases, likely resulting from infection with gas-producing bacteria such as *Staphylococcus* spp., *Streptococcus* spp., and *Escherichia coli*. Advanced lesions such as osteolysis, subchondral bone lysis, severe arthritic changes, and joint ankylosis were evident only in chronic cases. These findings are in agreement with Jackson (1999) [12] and Dogan *et al.* (2016) [2], who reported that soft tissue swelling is the primary radiographic feature in early joint infections”, while progressive bone destruction and cartilage erosion appear in later stages of the disease.

“Ultrasonographic evaluation in the current study proved valuable for early detection and staging of the septic process, as described by Kofler (1996) [8], Kofler (1997) [9], and Nuss and Maierl (2000) [10]. Affected joints demonstrated hypoechoic regions indicative of joint effusion. Normal synovial fluid appeared anechoic (black) on sonograms, while

cloudy or echogenic regions suggested the presence of pus, fibrin, inflammatory debris, or foreign material, corroborating the findings of Munroe and Cauvin (1994) [19], Jackson (1999) [12], Tremaine (2000) [20], and Lugo and Gaughan (2006) [14]. The varying echogenicity of inflammatory effusions observed in this study parallels the ultrasonographic findings reported by Dogan *et al.* (2016) [2] in calves with septic arthritis.”

5. Conclusion

Radiographic and ultrasonographic evaluations provided valuable diagnostic insights into septic arthritis in calves. Soft tissue swelling was identified as the earliest and most consistent radiographic feature, while ultrasonography proved more sensitive in detecting joint effusion and characterizing the inflammatory process. The combination of these imaging modalities allowed for early diagnosis, disease staging and effective monitoring of therapeutic response in affected calves.

Conflict of Interest

Not available

Financial Support

Not available

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