Streptococcus dysgalactiae Septic Arthritis of a Pre-Weaned Holstein Bull Calf - a Case Report

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ABSTRACT

Septic arthritis is a joint inflammation caused by an infectious agent. Septic arthritis takes a long time to heal, and as such it may have a significant economic impact. A one-month-old Friesian Holstein calf was lame and had swelling in the left carpal joint. Synovial fluid samples from the left carpal joint were used for bacterial identification, which use API Strept 20 (bioMérieux, Inc – USA). The identification results showed that septic arthritis was caused by *Streptococcus dysgalactiae* subspecies *dysgalactiae*,. *Streptococcus dysgalactiae* subspecies *dysgalactiae* play a significant role even though it plays a major role in mastitis in dairy cows.

Keywords: Carpal joint, Septic Arthritis, *Streptococcus dysgalactiae* subspecies *dysgalactiae*

INTRODUCTION

Arthritis is an acute to chronic inflammation of the joints that can have a bad economic impact on the farm. Joints are painful, swollen, and affected animals are often quite unthrifty, which is often caused by trauma and can be aseptic or septic. Aseptic inflammation is characterized by luxation to joint dislocation, while septic inflammation occurs due to the presence of infectious agents that enter through the wound due to trauma or the presence of systemic infection, such as pneumonia, omphalitis, and septicemia (Desrochers and Francoz, 2014; Constant et al., 2018; Yakan, 2023). Therapy is often unrewarding (Desrochers and Francoz, 2014).

Bacterial infection is the most common cause of septic arthritis (SA) although some reports of viral infection are related to SA. Gram-positive catalase-negative cocci is the most common bacteria found in the synovial fluid culture related to SA

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(Constant et al., 2018). One of which is *Streptococcus dysgalactiaae* (SD). SD has always been considered a major pathogen in bovine mastitis and also has been found associated with SA in sheep (An et al., 2021). The fact that it was possible to isolate this bacterium from septic arthritis of pre-weaned calf makes for a particularly interesting finding.

MATERIALS AND METHODS

Case Presentation

An intensive dairy cattle breeding farm in Subang area West Java province is raising approximately 1000 heifers of which 30% of them are pre-weaned calves and 30% of the calves are male. Some high numbers of respiratory problems and cases of purulent arthritis have been reported. As for sample purposes, one of the Friesian-Holstein male calves one month of age was used that showed exact symptoms of arthritis, which is experiencing swelling of the left carpal joint (Figure 1) and has lying frequency much longer compared to other calves. The examination of the musculoskeletal system and vital signs of the calf was performed according to Peek and Divers (2018).

Figure 1. SA on left carpal joint of the animal.

Complete Blood Count

The complete blood count (CBC) with differential analysis in red blood cell (RBC) and white blood cell (WBC using a hematology analyzer from Premeds 36H (Figure 2) was performed.

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Figure 2. Growth of *Streptococcus dysgalactiae* on blood agar

Bacterial Culture and Pathogen Identification

For bacterial culture, a joint aspirate was taken from the infected carpal joint aseptically. A bacterial culture was performed in the farm microbiology laboratory; the aerobic culture was using washed cow blood agar and MacConkey agar incubated at 37°C for 48 hours and continued with presumptive bacterial identification (Sirois, 2020). Mycoplasma culture was also performed from the same sample according to Nicholas et al. (2008).

For Streptococcal confirmation, Streptococcus Lancefield's grouping were done by using Microgen® Strep latex test and followed by specific bacterial identification using API® system by biomérieux; in this case, the API® 20 STREP identification system was used.

RESULTS AND DISCUSSION

Clinical examination revealed severe lameness in the calves. The animals showed lameness in the left-front leg (degree 4–5/5). The orthopedic examination of the calf indicated decubitus in both carpal joints and an open wound is shown in both cranial regions of the joints (Figure 3). There is no history of common diseases in this calf such as calf scours (diarrhea), omphalitis, nor pneumonia as for vaccination history, vaccine against Clostridiosis and Foot and Mouth Diseases (FMD) has been administered to the animal.

The bull calf showed a poor nutritional status with a long and scruffy coat. The estimated body weights were 70 kg, respectively. An anomaly was found in the vital parameters respiratory frequency was found in 88 per minute (normal range: 20–40 per minute) also the body temperature was 39.9 (normal range: 38.5–39.2°C)

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although the heart frequency was within the reference range (heart frequency: 72–100 bpm). So, it was concluded that the animal had pyrexia (Peek and Divers, 2018.)

Figure 3. Decubitus lesion shown on both front legs.

Hematological examinations that were performed included analysis of white blood cells, red blood cells, hemoglobin, leukocytes, and platelet levels—with results presented in Table 1. Based on hematological results, calves develop leukocytosis, which refers to an increase in white blood cells due to infection (bacterial, fungal, or parasitic), response to inflammation in the body, or as an indicator of stress (Roland *et* al., 2014; Kononov et al., 2022) which is also supported by the fact that the calf had a fever as described in vital sign assessment. This condition can be correlated with injuries to the left carpal joint area and the possibility of infection in the wound area that increases the number of blood cells as well as triggering the septic arthritis condition.

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Table 1 Complete Blood Cell Count Results

Parameter	Result	Unit	Ref. Range
WBC	29.37*	$10^3/\mu L$	4.00-12.00
Lym%	46.5	%	4.00-75.0
Gran%	39.6	%	15.0-65.0
Mid%	13.9*	%	20-10.0
Lym#	13.66*	$10^3/\mu L$	1.50-9.00
Gran#	11.63*	$10^3/\mu L$	0.60-5.00
Mid#	4.08*	$10^3/\mu L$	0.30-1.60
RBC	8.68	$10^3/\mu L$	5.00-10.10
HGB	9.1	g/dL	8.0-15.0
HCT	33.8	%	24.0-46.0
MCV	38.9**	fL	40.0-60.0
MCH	10.5**	pg	11.0-19.0
MCHC	27.0**	g/dL	30.0-37.0
RDW-CV	22.7*	%	14.0-19.0
RDW-SD	30.4	fL	0.1-99.9
PLT	885*	$10^3/\mu L$	120-820
MPV	18.6*	fL	3.8-7.0
PDW	7.9	fL	0.1-30.0
PCT	1.646	%	0.010-9.990

Note:
* Result is higher than the reference
**Result is lower than the reference

The blood count analysis also reveals a decrease in the Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), and Mean Corpuscular Hemoglobin Concentration (MCHC). MCV, MCH, and MCHC are the components of blood used as a population parameter of erythrocytes in individuals (Roland et al., 2014). The red blood hematology analysis shows that MCV and MCH level are 38.9 fL (normal range 40.0-60.0 fL) and 10.5 (normal range 11.0-19.0). Low MCV and MCH indicate that the animal has microcytic anemia. This condition is generally caused by iron deficiency (Joerling and Doll, 2019; Chaudhry and Kasarla, 2023). This can occur due to the animal not getting enough nutrition because of the difficulty of reaching the feed bunk, which is caused by severe lameness with high locomotion score, which is also shown in the physical examination of the calf.

A negative result was found in mycoplasma culture as aerobic culture indicates the presence of growth of colonies on blood agar, while no colonies growth is

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observed on MacConkey agar. From the presumptive identification, the bacteria were shown a typical streptococcal-like colony, gram-positive catalase-negative cocci and followed by Lancefield Streptococcal Grouping identification and the result showed the bacteria was positive for group C (Figure 4 and 5). Bacterial identification was continued with the API® 20 STREP identification system and the results were recovered the next day; the bacteria was identified as *S. dysgalactiae* subsp. *dysgalactiae* (SDSD) with %ID for 84%. So, it was concluded that the causative agent for septic arthritis is SDSD. SD includes two subspecies: SDSD and *S. dysgalactiae* subsp. *equisimilis* (SDSE). While SDSE has been recognized as an increasingly important human pathogen, SDSD has been considered a strictly animal pathogen and is associated with bovine mastitis (Alves-Barroco et al., 2021).

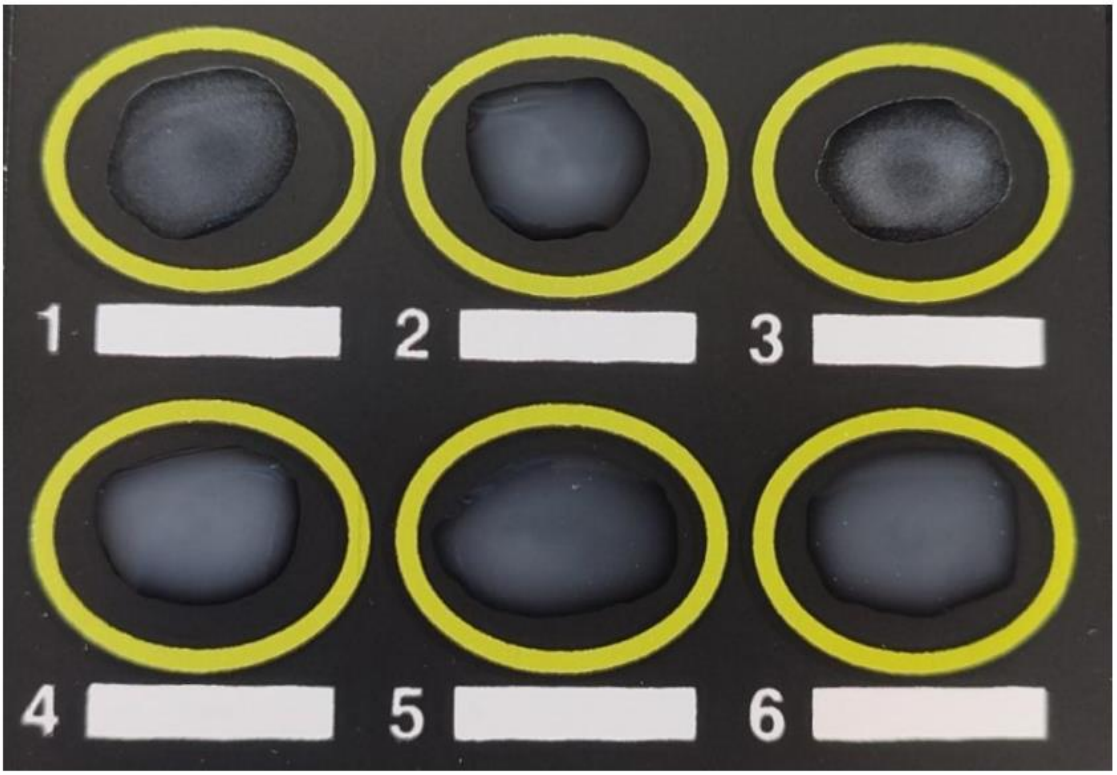

Figure 4. Latex Lancefield's Streptococcus Grouping: (1) *Streptococcus* group A; (2) *Streptococcus* group B; (3) *Streptococcus* group C; (4) *Streptococcus* group D; (5) *Streptococcus* group F; (6) *Streptococcus* group G.

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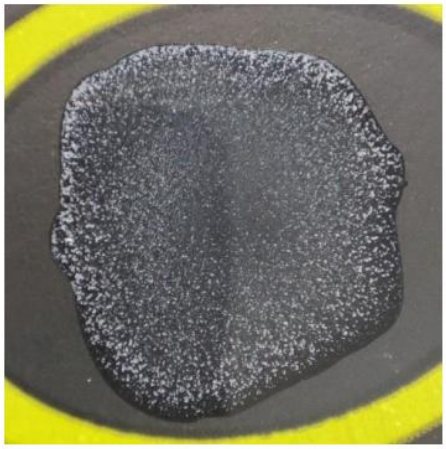

Figure 5. Latex Lancefield's *Streptococcus* group C

Numerous bacteria have been isolated from infected joints in cattle, in the calves with septic bursitis or arthritis, several bacteria, including *Staphylococcus spp*., *Acinetobacter wolfii, Trueperella pyogenes* and *Helcococcus ovis*, were isolated from the synovial cavities (Desrochers and Francoz, 2014; Jost and Sickinger, 2021), furthermore Constant et al. (2018)observed a septic arthritis case of 64 cases of calves and revealed gram-positive catalase-negative cocci were the most frequently identified type of bacteria isolated from the septic joints of calves, and *Streptococcus* was the most commonly isolated genus. So, it is not surprising that SDSD was related to septic arthritis in this case, although there are not many reports made for causative agents of SA related to young ruminants in Indonesia.

The umbilicus is a very common route of infection. Inadequate hygiene and disinfection of the umbilicus afterbirth and passive immunity transfer failure are the most important factors contributing to umbilical infection (Desrochers and Francoz,, 2014). However, from the historical data, it is known that the calf has no history of naval infection. Other frequent newborn infections must be considered if the umbilicus is normal: pneumonia, diarrhea, septicemia, and other systemic infections (Desrochers and Francoz, 2014; Constant et al., 2018). Nevertheless, the most important aspect of managing newborn infection is the passive transfer of first-day colostrum (Desrochers and Francoz, 2014; Constant et al., 2018; Jost and Sickinger, 2021). Due to economic considerations, milk that is not suitable for sale is frequently fed to dairy calves. This milk often originates from diseased cows and thus is contaminated with antibiotics or pathogenic microorganisms. Feeding untreated mastitis milk can facilitate the transmission of infectious pathogens and

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provoke disease in calves (Abb-Schwedler et al., 2014; Penati et al., 2021) which includes SA as shown in mycoplasma-related SA in calves and lamb (Nicholas et al., 2008). The calf in this case also received pasteurized mastitis milk as fed after a few days of birth.

The treatment of septic arthritis and tenosynovitis mainly entails joint lavages including antibiotic and anti-inflammatory approaches, as well as surgical techniques like arthrotomy or arthrodesis (Desrochers and Francoz, 2014; Peek and Divers, 2018; Jost and Sickinger, 2021). Due to economic aspects, surgical techniques like arthroscopy or arthrotomy are reserved for animals with high genetic value and companion animals (Desrochers and Francoz, 2014). As the bull calf, in this case, was considered of low economic value due to the breeding farm which only kept the dairy heifers, the calf received an antibiotic and anti-inflammatory regime, which is spectinomycin and lincomycin as antibiotic therapy followed by flunixin meglumine as an anti-inflammatory.

Due to the accumulation of septic arthritis cases at the farm and financial limitations, a larger focus was placed on prevention instead of treating these diseases. Therefore, the focus was shifted to the results obtained from the bacteriological examinations. General recommendations to reduce the incidence of SA, such as improving stable hygiene and immediately installing a separate box for calving, were made. When the calves were born, they were immediately put in a pen box with a base concrete plastic cage without any added straw as a cushion in the base of the box (**Figure 6**). This is also a factor predisposing to a high incidence of arthritis cases on the farm. Hard bedding has a significant correlation with the incidence of arthritis (Medina-González et al., 2021). A new pasteurizer machine is taking place and standard operating procedures (SOP) were made to make sure that milk from mastitis cows was fully pasteurized. Heat treatment of milk originating from cows suffering from mastitis is a reasonable measure to reduce the risk of calf diseases. Furthermore, this technique is sustainable, as discarding the milk from cows with mastitis can be avoided (Abb-Schwedler et al., 2014). Another SOP also took place for measuring the colostrum quality and it was advised to collect and store high-quality colostrum. The amount of colostrum administered to each calf within the first hours of birth was considered sufficient (4 L within the first 6–8 h) (Jost and Sickinger, 2021). After adhering to most of these suggestions, the herds' health improved significantly.

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Strip	API 20 STREP V8.0
Profile	0 4 6 2 4 1 1
Note	CONFIRM BY SEROLOGICAL TESTS

Significant taxa	% ID	T	Tests against			
Streptococcus dysgalactiae ssp dysgalactiae	84.3	0.67	ADH 100%			
Streptococcus dysgalactiae ssp equisimilis	14.5	0.56	ADH 97%	HEM 94%		

Next taxon	% ID	T	Tests against			
Aerococcus urinae	0.9	0.62	HIP 99%			

Complementary test(s)	GLYCEROL	MILK(A)		
Streptococcus dysgalactiae ssp dysgalactiae	-	+		
Streptococcus dysgalactiae ssp equisimilis	+	-		

Figure 6. API 20 STREP identification result

CONCLUSION

SDSD causes SA in calves, and empiric therapies should also cover this organism. When dealing with SA in young animals, a proper management approach for raising heifers should be considered; proper equipment and SOPs for hygiene and sanitation need to be provided to ensure calves' health. Prevention is better than cure.

ETHICS APPROVAL

This case report did not require ethical clearance as data of medical records, physical examinations, and laboratory diagnostics, including hematology, bacterial

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culture, and identifications, were performed by certified veterinarians or under the supervision of certified veterinarians.

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