# Quiet Puppy, Big Problems

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## Introduction

Juvenile cellulitis, otherwise known as “puppy strangles,” is a rare condition found in puppies. It has previously been known to be fatal if left untreated, but it has become increasingly more well-known among the veterinary profession.[1] It is an inflammatory, progressive, pyogranulomatous disease seen in young dogs.[3,9] Typically, this is frequently found in dogs less than four months of age, but there are several reports of this disease occurring in older dogs, up to four years of age.[2,3,6,7]

Juvenile cellulitis is characterized as a systemic disease instead of a localized disease due to the common clinical signs associated with the disease process.[9] Common clinical signs include lesions affecting the face, pinnae, muzzle, abdomen, and paws.[3,5] Typically, these painful lesions will present as reddened papules that ulcerate and drain, then eventually crust over.[3] Common signs associated with juvenile cellulitis include lymphadenopathy, particularly of the submandibular lymph nodes, lameness, pyrexia, and generalized lethargy.[3,5]

Diagnosis is predominantly reliant on clinical signs.[3,5,9,10] Other methods to support the diagnosis of juvenile cellulitis include cytology and histopathology.[2] Considering this disease is commonly found in young dogs, the treatment of choice, steroids, can be controversial for use as it may cause severe immunosuppression and increase the risk of concurrent diseases. The prognosis is good for complete recovery; however, dependent on early diagnosis, scarring can occur.[10]

## History and Presentation

Riley is a 9-week-old, female intact, goldendoodle that presented to MSU-CVM emergency service as a referral for increased lethargy, weakness, pyrexia, bronchitis/

pneumonitis, and painful joints. On Friday evening, September 6, 2019, Riley appeared somewhat lethargic. The owner was initially not overtly concerned because she had a few busy days, and Riley was adjusting to her new lifestyle. However, Riley's lethargy progressed to weakness and inability to walk. She was taken to an emergency facility to be evaluated. Riley was given fluids and antibiotics (cefazolin and Penicillin G), as well as an anti-inflammatory medication (meloxicam) for her pyrexia. The following Monday, Riley was transferred to her primary care veterinarian for continued work-up and treatment. The fluids and meloxicam were continued, and Clavamox, doxycycline, and tramadol were added. Thoracic radiographs, as well as radiographs of all four extremities, were taken. The films were interpreted by Idexx. A pulmonary pattern consistent with bronchitis or pneumonitis was present, and there were no significant findings in any of the extremities. Riley appeared brighter after treatment; therefore, she was discharged. Although Riley's demeanor and pyrexia improved, she continued to be painful and stiff in her joints. It was recommended that Riley see a neurologist or an orthopedist for her joint pain and weakness; therefore, she was referred to MSU-CVM.

Riley presented to MSU-CVM emergency department on September 10, 2019. Her presenting physical exam revealed that she was dull, but responsive. She weighed 7.14 kg with a body condition score (BCS) of 5/9. Her heart rate was 161 beats per minute, with no arrhythmias or murmurs heard. Increased, harsh lung sounds were heard on thoracic auscultation and she had a respiratory rate of 60 breaths per minute. Her temperature was 103.2°F. She appeared well hydrated with no skin tent, and pink, moist mucous membranes. She had a CRT of 1 second. Riley had mildly enlarged submandibular lymph nodes, bilaterally. There were papules on the external pinna and a moderate amount of brown, ceruminous debris in her ears, bilaterally. Her abdomen was tense, but non-painful on palpation. All other physical exam parameters were

within the normal limits. Orthopedic exam revealed pain on palpation of carpi and elbows, bilaterally. Neurologic exam did not reveal any neurological deficits. She was noted to have weakness in all four limbs and was unable to bear weight on both forelimbs. She was admitted for hospitalization for supportive care and started on Clavamox and buprenorphine overnight. Riley was then transferred to the Internal Medicine department.

The following morning, Riley appeared mildly brighter and less painful than her original presentation; however, she would not stand for a prolonged period of time and remained weak. She had normal urination and defecation. The harsh lung sounds found on initial presentation were not appreciated. The remainder of her physical exam remained unchanged. Consultation with the dermatologist was obtained. Given Riley's clinical signs, juvenile cellulitis was suspected as a differential. Some of her presenting clinical signs were atypical in nature to juvenile cellulitis, so staphylococcal pyoderma, pemphigus foliaceous, septic arthritis, soft tissue injury, and orthopedic injury were considered as other differential diagnoses.

**Diagnostic Approach**

Juvenile cellulitis is a disease most commonly diagnosed based on clinical signs, but it is also supported through cytology, skin biopsies, and histopathology.[2,3,5,10] Most frequently, the patient presents acutely with dermatitis of the face and head characterized by swelling of the muzzle, eyelids, and ears.[9,10] The lesions seen on presentation can extend to the pinna, paws, abdomen, thorax, vulva, and prepuce, drain exudative material, and crust.[3] Affected dogs will usually also develop lymphadenopathy; this has been reported to occur both before the presentation of dermatitis as well as after.[2,10] Most commonly, the mandibular and submandibular lymph nodes are enlarged, but the prescapular lymph nodes have been reported to

be involved.[5] There was also a study of a clinically affected dog with histological evidence in his popliteal node.[10] Other less common presenting signs include anorexia, lethargy, lameness, and pyrexia.[1,2,5] The lesions seen in these puppies are typically painful, not pruritic.[5,10]

Cytological evaluation of the lymph nodes reveals neutrophilic inflammation with an epithelioid macrophage as the predominant inflammatory cell.[3,5,7,9] These cells have a round, central nucleus, an arm absent of organelles, and phagocytic vacuoles in the cytoplasm.[9] Bacterial, fungal, viral, and other infectious agents have not yet been isolated.[7] Arthrocentesis performed on swollen and painful joints reveals a sterile suppurative arthritis.[5] Histopathological evaluation of the affected lymph nodes reveals a severe, chronic, multifocal, coalescing pyogranulomatous lymphadenitis.[3] The primary pathological pattern on skin biopsies in early lesions is granulomatous to pyogranulomatous inflammation. In later lesions, suppurative changes occur in the superficial dermis as well as around ruptured hair follicles causing a mild acute focal periadnexal dermatitis.[3,8] Bacterial cultures of the papulopustular lesions are sterile.[3,5,9]

For Riley, a complete blood count and biochemistry profile revealed no concerning abnormalities. A skin scrape was performed to check for possible demodicosis; no mites were noted. Riley was sedated for an arthrocentesis of the stifle and carpi. Grossly, the synovial fluid was slightly thin. Cytology of the joint fluid revealed neutrophilic inflammation and the culture did not reveal any bacterial growth. Culture of purulent material from a lesion on her pinna revealed growth from enrichment broth only of Bacillus sp., which was suspected to be a possible contaminant. Skin biopsies are a strong diagnostic indicator for juvenile cellulitis. Unfortunately, a skin biopsy was not obtained on Riley due to her atypical presentation. Her skin lesions were not as well-defined; the lesions on her pinnae were more well-defined but were in a

difficult location to obtain a biopsy. Riley's other diagnostic findings such as her signalment, arthrocentesis, and culture were consistent with the previously reported findings of juvenile cellulitis.

**Pathophysiology**

Juvenile cellulitis is considered idiopathic in nature.[1] Although different etiologies have been discussed, no specific etiology has been proven successful. The proposed theories include hereditability, infectious, and vaccine-related.[2,7,9,10] Many reports document this condition presenting more frequently in certain breeds such as the Golden Retriever, Dachshunds, and Gordon Setters favoring the genetic theory.[1,2,7] A study showing the disease occurring in several littermates that also exhibited systemic signs was strongly suggestive of the infectious theory; in attempts to support this theory, an infectious agent was unable to be identified.[7,9] Since this disease develops during the early immunization period, it is also hypothesized to be vaccine-related.[9,10] In a study by Malik et al. to identify vaccine involvement in the disease, a small sample of puppies were inoculated with the modified live distemper vaccine, and developed metaphyseal osteopathy with concurrent juvenile cellulitis. Although considered, viral involvement could not be scientifically proven.[2] Because of these aforementioned findings, juvenile cellulitis is considered a rare, idiopathic, immune-mediated disease.

**Treatment and Management**

Due to the fact that juvenile cellulitis occurs mostly in young dogs, the treatment of choice, steroids, can be risky to use. The immune systems in young dogs are still adapting to environmental triggers at this age, so introducing an immunosuppressive dose of a steroid, which

will immunosuppress the patient even more, is a frightening thought. The quickest and most appropriate therapy for this condition is a steroid such as prednisone (2 mg/kg/d), and an antibiotic such as Clavamox or cephalexin.[1,2,3,5,9,10,12] There is typically a quick response when using the medications concurrently.[2,5] When using antibiotics alone, the resolution of disease is much slower, taking up to fifteen weeks in one report.[2]

Riley was continued on Clavamox (17 mg/kg) and Buprenorphine (0.01 mg/kg) in the hospital. In addition, immunosuppressive therapy at 2 mg/kg with a corticosteroid was initiated. Riley showed dramatic improvement of her clinical signs including resolved pain and improved strength, and she was walking at the time of discharge. As a result, she was discharged with Clavamox (15 mg/kg PO q12h) and prednisone (2 mg/kg PO q24h) with instructions to recheck with her primary veterinarian in one week for reevaluation.

Prognosis is good for patients that receive early diagnosis and treatment.[7,12] It has been reported that a patient recovered after seven weeks without treatment.[9] However, it is also known that the disease can be fatal and severe scarring can occur if left untreated.[1] Relapses do not commonly occur if treated appropriately, but are rarely reported.[7,12]

**Case Outcome**

According to Boehringer Ingelheim Veterinary Technical Solutions team, it was recommended that Riley receive the BI Recombitek DHPP vaccine at approximately sixteen weeks, or nine to ten days, after her immunosuppressive dose of prednisone was discontinued. This particular vaccine does not have a modified live version of distemper in it. It was recommended to wait until the prednisone dose was discontinued, because while on a steroid, the immune system may inhibit a protective response to the vaccine. The DHPP vaccine will then be

boostered at approximately twenty weeks, or in three to four weeks, with another Recombitek DHPP vaccine or with a monovalent parvovirus vaccine. In addition, it was encouraged that Riley should be withheld administration of her rabies vaccine until she was fully tapered off of the prednisone or until two weeks after her last dose of DHPP is given. It was evident that Riley has an immune-mediated disease due to her suspected diagnosis of juvenile cellulitis; therefore, it was ideal for her vaccine administration be spread out. By dispersing her vaccines over time, Riley could potentially avoid another inflammatory event.

Riley was discharged September 12, 2019. With at-home care being a pertinent factor in the prevention of new disease, client communication was imperative for this case. While on prednisone, Riley was immunosuppressed; therefore, it was recommended to isolate her from other animals and to avoid public places such as a groomer or dog park. By September 17, 2019, Riley was doing great and almost back to a normal activity level. Her skin lesions were still present and some on her back had ruptured. At this time, it was recommended that her antibiotics be discontinued as her culture was negative. By October 3, 2019, the owner reported that Riley was completely back to normal at home. She was a superior client when it came to following at-home instructions. Since she lived in an apartment and would have to walk Riley in a public place, she purchased a turf mat for inside the home; this allowed Riley to isolate herself from a public location as well as continue her training. Socialization is important in young animals, so once her prednisone was tapered, she would schedule play dates with vaccinated dogs that did not have access to public places. By October 7, 2019, the primary veterinarian had started slowly tapering Riley's prednisone dose. Her last dose of Prednisone was given on November 6, 2019. Her vaccine schedule was continued based on the recommendations given by the Boehringer Ingelheim Veterinary Technical Solutions team. Her rabies vaccine was separated from her

DHPP vaccine and she has tolerated them all very well. She is doing fantastic at home and will be getting her spay soon.

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