

Preamanalytical Considerations for Joint Fluid Evaluation



Caitlyn R. Martinez, DVM, Kelly S. Santangelo, DVM, PhD*

KEYWORDS

- Synovial fluid • Orthopedics • Osteoarthritis • Immune-mediated polyarthropathy
- Septic arthritis

KEY POINTS

- Synovial fluid analysis is a key component of the minimum database needed to diagnose and manage primary and secondary articular joint disorders.
- Preamanalytical variables can drastically alter samples submitted to veterinary laboratories for evaluation and it is considered the stage at which most laboratory error occurs.
- Common indications for the collection of synovial fluid include orthopedic lameness; abnormal limb function or gait; articular pain and/or distention; fever of unknown origin; or widespread pain, stiffness, or difficulty moving.
- The gross characteristics of synovial fluid yield important information as to the quality and pathology of the joint and should be noted at the time of sample collection.
- When arthrocentesis yields small sample volumes, cytologic evaluation of direct smears offers the most clinically relevant information available from synovial fluid.

INTRODUCTION

In concert with clinical history, physical examination, imaging modalities, and other clinical pathology findings, synovial fluid analysis is a key component of the minimum database needed to diagnose and manage primary and secondary articular joint disorders. The preanalytical phase of synovial fluid evaluation encompasses the steps from initial sample collection through final arrival and accessioning at the diagnostic laboratory. Unfortunately, preanalytical variables can drastically alter samples submitted for evaluation to veterinary laboratories and it is considered the stage at which most laboratory error occurs.¹ Specific variables that may influence the interpretation

The authors have nothing to disclose.

Department of Microbiology, Immunology, and Pathology, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, 1644 Campus Delivery, Fort Collins, CO 80523, USA

* Corresponding author.

E-mail address: kelly.santangelo@colostate.edu

Vet Clin Small Anim 47 (2017) 111–122

<http://dx.doi.org/10.1016/j.cvsm.2016.07.007>

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of joint fluid mostly involve technical factors, such as selection of collection materials, evidence of blood contamination, and specimen handling. Other considerations that should be included with sample submission include the location that was aspirated, the signalment and presenting signs of the animal, and current medications being administered. With consistent preanalytical quality control and reporting of specimens, downstream clinical decision making and management of patients can be accelerated and improved. General practitioners should always feel comfortable contacting a diagnostic laboratory for specific information regarding sample acquisition, processing, and submission.^{2,3}

ORIGINS AND CHARACTERISTICS OF SYNOVIAL FLUID

Joints are the points of interaction and movement between 2 adjacent bones. Hyaline cartilage overlays the subchondral bone and is the contact surface. Chondrocytes within the articular cartilage produce the proteoglycans present in the cartilage. This articular space is enclosed by a joint capsule. The joint capsule is composed of a tough, fibrous external surface, a vascular subsynovial layer, and the lining synovial surface. The synovium is thin and contains 2 types of cells, or synoviocytes. These cells are either phagocytic and thus similar to macrophages (type A synoviocytes), or they produce hyaluronic acid, a glycosaminoglycan (type B synoviocytes).⁴ Both types of synoviocytes can be visualized on cytologic preparations of synovial fluid, but are typically difficult to differentiate in normal joints and are classified together as large mononuclear cells.

Synovial fluid from a nondiseased joint is an ultrafiltrate of plasma that is modified by secretion of hyaluronic acid, glycoproteins, and other macromolecules. Smaller molecules, such as glucose and electrolytes, can occur in synovial fluid in concentrations equivalent to those in plasma. Proteins from plasma, however, are included in this synovial dialysate only to a limited extent. Synovial fluid serves 2 major purposes. First, it provides a source of nutrition and waste removal from articular chondrocytes. Second, joint fluid lubricates opposing articular cartilage surfaces, limiting friction and wear during contact. Although hyaluronic acid has some lubricating properties, glycoproteins are the primary source of reduced friction during joint motion.

When the components of the joint become diseased, injured, and/or inflamed, pathology is frequently reflected by changes within synovial fluid. Evidence of abnormal conditions include joint effusion with decreased viscosity and increased protein content, increased numbers of inflammatory cells, changes in the percentages of different cell types present, and intra-articular hemorrhage.

INDICATIONS FOR COLLECTION OF SYNOVIAL FLUID

Synovial fluid analysis is a critical aspect of the workup for an animal exhibiting joint issues, whether these concerns are primary maladies localized to one or more limbs or reflect the secondary manifestation of a systemic condition. Importantly, these data must be integrated with other clinical and laboratory findings, including culture, serology, antinuclear antibody titer, and rheumatoid factor titer. Common indications for the collection of synovial fluid include orthopedic lameness, abnormal limb function or gait, articular pain and/or distention; fever of unknown origin; or widespread pain, stiffness, or difficulty moving.⁵

Typical characteristics of synovial fluid from dogs and cats are presented in **Table 1**. Normal synovial fluid is light yellow and clear, with no observable particular material. The volume that can be aspirated depends on the joint being sampled and the condition of the joint. For most large breed dogs, less than 0.5 mL of synovial fluid is

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