



## Use of Arthrocentesis in Diagnosing Joint Disease

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**A**RTHROCENTESIS is a safe, quick, and relatively easy procedure that can be performed in most clinical settings. The equipment needed is minimal and inexpensive, and the techniques are not difficult to learn. Coupled with a good examination and appropriate ancillary diagnostics, the information obtained from a successful joint tap is invaluable in attempting to differentiate between the various classes of joint disease. Correct identification of the disease process will then allow the clinician to offer the most appropriate form of treatment.

### Initial Considerations

Lameness or gait abnormality is a common presentation seen in animals with joint disease. Animals with polyarthropathies often walk with a stiff gait, and owners may describe their pet as "walking on eggshells." When severe joint pain is present, the animal may refuse to rise and cry out when touched. Occasionally (especially in cats), fever and lethargy are the sole presenting signs. As many of these signs can suggest other disease processes, it is extremely important to obtain an accurate history and perform a thorough physical examination. Along with standard questions, trauma history, exposure to antico-

agulants, drug use, and travel history should be addressed. The physical examination should include a thorough musculoskeletal and neurologic examination to help the clinician differentiate joint disease from primary orthopedic or neurologic problems. Although careful attention must be paid to evaluating joints for effusion and pain with flexion or extension, it is extremely important to note that significant joint disease can be present despite a lack of abnormalities found by joint palpation. Whenever joint pain or effusion is present, the clinician should be highly suspicious of joint disease.

Initial diagnostic testing that should be considered before joint taps are done include a CBC, chemistry profile, urinalysis/urine culture, and radiographs of affected and corresponding nonaffected joints. A coagulation panel can be submitted if hemarthrosis secondary to toxicity or inherited disease is suspected. Further studies, such as serologic testing for infectious agents (*Borrelia*, *Ehrlichia*, *Rickettsia*, and *Toxoplasma* species) and systemic testing for immune-mediated disease (such as antinuclear antibody or a urine protein-creatinine ratio), should also be considered when appropriate historical or clinical signs are present or after joint tap results have been evaluated. Blood cultures may also be considered to look for a systemic infectious cause of joint inflammation.

### Classification of Joint Disease

Joint disease is typically classified as being inflammatory and infectious, inflammatory and noninfectious, or noninflammatory (Table 1). Idiopathic immune-mediated polyarthropathy is a common form of inflammatory

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Table 1. Classification of Joint Disease

#### INFLAMMATORY

##### Infectious

- Rickettsial
- Bacterial (septic, Lyme, *Mycoplasma*, L-forms [in cats])
- Protozoal
- Fungal
- Viral (*Calicivirus* in cats)

##### Noninfectious

- Nonerosive
- Idiopathic immune-mediated polyarthropathy
- Systemic lupus erythematosus
- Immune-mediated secondary to chronic inflammatory disease, drug reaction, or paraneoplastic syndrome
- Lymphocytic-plasmacytic polyarthritis
- Neoplasia (more often noninflammatory)

##### Erosive

- Rheumatoid arthritis
- Erosive polyarthropathy of greyhounds
- Feline chronic progressive polyarthropathy

#### NONINFLAMMATORY

##### Degenerative joint disease

##### Trauma

- Neoplasia (usually primary)
- Hemarthrosis (secondary to coagulopathy)

ry joint disease, but should never be diagnosed without a complete workup, including serologic testing and arthrocentesis.

## General Considerations

Arthrocentesis should ideally be performed whenever inflammatory joint disease is suspected. Obtaining joint fluid for cytologic and microbiological evaluation will aid in differentiating between the various types of inflammatory processes. The character of diseased synovial fluid is altered in several ways (**Table 2**). In general, affected fluid is less viscous and white blood cell count is increased. In addition to being an excellent tool to gain valuable information about any specific disease processes, complications from joint taps are

rare. Complications may include iatrogenic infection, hemarthrosis, or mild pain. To reduce the risk for iatrogenic infection, joint taps should always be done with sterile technique.

Joint taps are not especially painful. However, most animals need some sedation, and cats and fractious animals usually need a deeper plane of sedation (**Table 3**).

Animals may present with one (monoarthropathy) or several (polyarthropathy) affected joints. Even when only one joint seems to be clinically affected, several sites should be tapped (at least 3 is routine) to detect subclinical joint involvement that would support a diagnosis of polyarthropathy. In general, the most obviously affected joint is tapped first.

Keep in mind that diseased joints will not always have a large amount of effusion. It is more important to get a sample that is not contaminated by blood than a large sample. Also remember that you will obtain only small amounts of fluid from nonaffected joints.

## Sample Handling

Joint fluid should be grossly evaluated for color and viscosity at the time of the tap. Normal synovial fluid should be clear, slightly thick, and sticky. A change in the color of the joint fluid can indicate disease or blood contamination. If the sample is contaminated by blood as a result of a traumatic tap, the blood usually does not mix evenly, whereas blood from ongoing hemorrhage into the joint

Table 2. Classification of Synovial Fluid\*

Variable	Normal	Trauma or Hemarthrosis	Degenerative Arthropathy	Inflammatory Arthropathy
Appearance	Clear to straw-colored	Clear to red	Clear to yellow	Yellow to bloody, often hazy or cloudy
Protein	< 2.5 g/dl	Variable	< 2.5 g/dl	Often > 2.5 g/dl
Viscosity	High	Decreased	Normal to decreased	Decreased
Nucleated cell count (cell/ $\mu$ l)	< 3000	Increased RBCs, nucleated count relative to blood	1000 to 10,000	5000 to > 100,000
Neutrophils	< 5%	Relative to blood	< 10%	> 10% to 100%
Mononuclear cells	> 95%	Relative to blood	> 90%	10% to < 90%
Comments	Only a small amount of fluid should be present	Erythrophagia helps to confirm previous hemorrhage	Cells are typically macrophages and may be vacuolated	Wide variation in nucleated cell count exists and is dependent on the specific disease process. Refer to cytology references for more specific information.

\*Adapted from *Atlas of Canine and Feline Cytology*. Philadelphia: WB Saunders, 2001, and Laboratory evaluation and interpretation of synovial fluid. *Vet Clin North Am Small Anim Pract* 33:153-178, 2003.

Table 3. Sedation Protocols for Joint Taps\*

<i>Agent</i>	<i>Dose</i>	<i>Route</i>	<i>Species</i>
Acepromazine + hydromorphone	0.01–0.1 mg/kg 0.05–0.2 mg/kg	IV or IM IV or IM	Dogs or cats Dogs or cats
or butorphanol	0.2–0.4 mg/kg	IV or IM	Dogs or cats
Diazepam or midazolam	0.1–0.2 mg/kg	IV	Dogs or cats
Diazepam or midazolam + propofol or ketamine	0.1–0.2 mg/kg 3–6 mg/kg 5–8 mg/kg	IV IV IV or IM	Dogs or cats Dogs or cats Cats
Medetomidine	5–30 µg/kg	IM	Dogs

\*Many other protocols are possible. The actual choice of sedation largely depends on the experience and comfort level of the clinician.

appears evenly distributed. The viscosity may be roughly estimated by ejecting one drop of the fluid onto a slide and (without touching the needle to the slide) assessing the length of the resultant string that forms when the needle is slowly withdrawn from the slide (2.5 cm is considered normal). A watery consistency that does not form a string is indicative of disease. The slide can then be used to prepare a smear for cytologic evaluation. Many taps yield only a few drops of fluid, and complete fluid analysis may be difficult—regardless, always submit slides for cytologic evaluation because determining the type of cells in the fluid is likely to be the most helpful piece of information in defining the disease process.

Counting the number of cells in the sample is important and, if enough fluid can be obtained, place a small amount of fluid in an EDTA tube for fluid analysis. Finally, culture

and sensitivity testing should be done on at least one joint if possible. The probability of bacterial infection is generally believed to be higher with monoarthropathies and purulent-appearing samples. Some clinicians advocate using enrichment broth because joint infections (especially *Mycoplasma*) can be difficult

to culture. Communication with the microbiology laboratory is recommended if fastidious or slow-growing organisms, such as *Mycoplasma*, are to be successfully isolated.

## Cytologic Evaluation

Synovial fluid analysis is very helpful to distinguish between inflammatory and noninflammatory disease processes (Table 1). However, once an inflammatory process is defined, there is considerable overlap in cytology results between the specific causes of inflammation. In general, inflammatory disease is characterized by the presence of increased numbers of neutrophils and a variable increase in large, mononuclear cells in the joint fluid. Septic joints tend to have a very high number of neutrophils, which may also exhibit degenerative changes. Bacterial organisms are usually not seen, and *Ehrlichia morulae* are seen infrequently. Increased numbers of nondegenerate neutrophils are generally seen with an immune-mediated process. Please consult **Aids & Resources** for a more complete review of cytologic changes in joint disease.

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## What You Will Need

Have your entire setup in place before beginning the procedure.

- Scrub, alcohol, and gauze for sterile preparation
- Sterile 3-ml syringes
- 22-gauge, 1-inch needles (for small dogs and cats)
- 22-gauge, 1.5-inch needles (may be necessary for large dogs for stifle joint, elbow, or shoulder taps)
- 25-gauge, 5/8-inch needles (may be needed for very small animals)
- Sterile gloves
- Culturette or culture media
- Slides
- EDTA tubes



## General Techniques

Before beginning the procedure, be sure to familiarize yourself with the appropriate anatomy/landmarks for each joint.

1. Position animal in lateral recumbency with the selected joint(s) on the upper side.
2. Using aseptic technique, clip and prepare the chosen joint.
3. Put on sterile gloves.
4. Have an assistant open the syringe case and place the syringe aseptically on a sterile field. (You can use the open glove package.)
5. Have an assistant open and hold the needle case. Pick up the syringe and place it aseptically onto the needle. Place pressure against the needle then pull back as your assistant is removing the needle cap. This procedure will leave you holding a sterile needle and syringe.
6. With the joint flexed, palpate appropriate landmarks for the specific joint. This is done with the opposite hand that you will use for aspiration of the joint.
7. Holding the syringe, pass the needle through the skin, joint capsule, and synovial membrane and into the joint cavity. (It is unlikely that you will be able to feel the needle penetrate each layer). Attempt to avoid articular cartilage, but if bone is encountered, you can pull back slightly and redirect the needle.
8. Gently aspirate. Unless the joint is severely distended, you may obtain only a few drops in the hub of the needle. As soon as fluid appears in the hub of the needle, release negative pressure and remove the needle from the joint. If blood is seen at any point in the procedure, immediately release pressure and remove the needle.
9. Aliquot and examine samples (See **Cytologic Evaluation** section, page 47.)
10. A large amount of blood makes cytologic evaluation too difficult, and tapping a new joint space is advisable. A small amount of blood may be present in the joint space and may actually be part of the disease process.

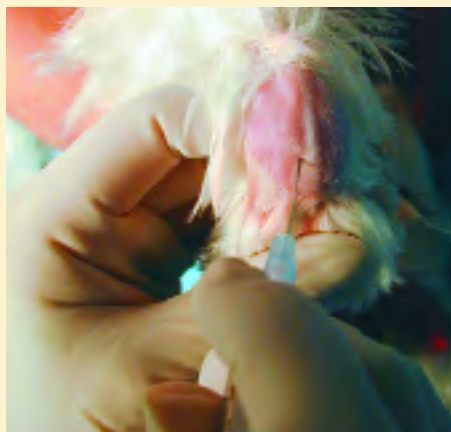
## STEP BY STEP HOW TO PERFORM ARTHROCENTESIS

### Approaches to Specific Joints The following discussion is presented in order

#### CARPAL JOINT



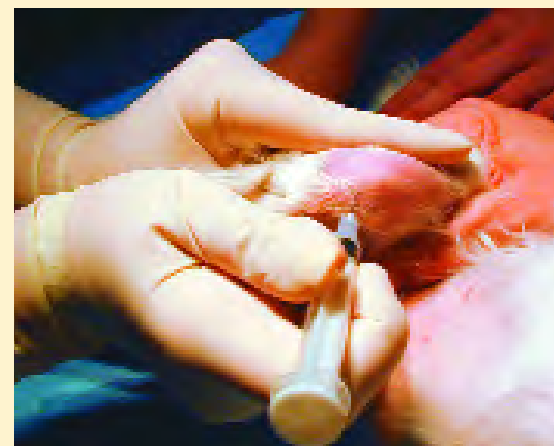
You should be able to palpate the space between the radius and proximal carpal bones, the proximal carpal bones and distal carpal bones, and the carpal and metacarpal bones. With the hand you are not using for aspiration, flex the joint to achieve a maximum amount of open joint space. The most common joint space to be tapped is the radio-carpal joint. The larger the space, the easier it is to obtain a good sample. Holding the syringe, insert the needle from the cranial surface through the skin and joint capsule and into the joint space. Avoid the prominent accessory cephalic vein on the dorsal surface.



#### STIFLE JOINT



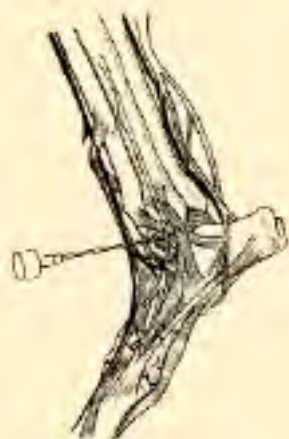
The stifle joint is large and may be approached from either the medial or lateral aspect. Flex the stifle joint to open the joint space. Insert the needle from the cranial aspect and lateral or medial to the patellar ligament. You should enter the joint approximately halfway between the patella and tibial tuberosity. Angle the needle toward the center of the joint. It may be helpful to apply digital pressure to the opposite side of the patellar ligament to cause joint fluid to collect toward your approach. Remember, there is a fat pad present that may interfere with obtaining fluid. If fluid is not obtained initially, back the needle up, redirect, and aspirate.





of increasing difficulty.

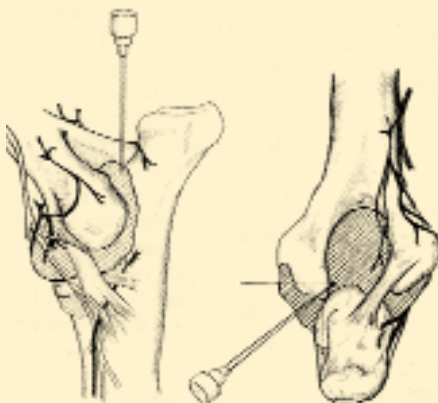
### TARSAL JOINT



There are two small joint spaces that can be tapped in the tarsus. One approach is to slightly flex the joint and palpate the cranial space between the tibia and tibiotarsal bone. Insert the needle from the cranial and lateral aspect and direct it in a medial direction. Keep in mind that this joint is shallow, and you will not need to advance the needle very far. The second approach is from the distal aspect and is accomplished by more fully flexing the tarsal joint to open the space between the distal fibula, tibia, and calcaneus bones. Palpate this space and insert the needle from a caudolateral position. The needle should be advanced parallel to calcaneus in a distal and slightly medial direction.



### ELBOW



Flex the elbow to approximately a 45-degree angle; this opens the space between the humerus and the ulna. Insert the needle between the olecranon process and the lateral condyle of the humerus and advance it in a distal and slightly medial direction, following the cranial surface of the ulna. You may also attempt to enter this space from the lateral aspect by entering the joint between the ulna and the lateral condyle of the humerus.



### SCAPULOHUMERAL JOINT



Flex the joint slightly to widen the space. Palpate the acromion process of the scapula and the greater tubercle. Approach the joint from the lateral aspect and insert the needle slightly cranial and distal to the acromion process and just caudal to the greater tubercle. The needle should be directed in a caudal-medial and slightly downward direction. It is also possible to approach the joint space from a cranial direction. Insert the needle medial to the greater tubercle and ventral to the supraglenoid tubercle, angling it in a cranial-caudal direction. ■



### ILLUSTRATIONS

Reprinted from *Manual of Clinical Procedures in the Dog & Cat*. Crow SE, Walshaw SO. Philadelphia: Lippincott, 1987, with permission from Blackwell Publishing

See Aids & Resources, back page, for references, contacts, and appendices.