

The Use of Ultrasonography for Detection of Meniscal Damage in Dogs

A Knowledge Summary by

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ISSN: 2396-9776

Published: 11 Jun 2019

in: Vol 4, Issue 2

DOI: <http://dx.doi.org/10.18849/ve.v4i2.207>

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Next Review Date: May 21st 2020



PICO question

In dogs, what is the sensitivity and specificity of using ultrasound as a diagnostic test to identify meniscal damage?

Clinical bottom line

Although there are limited studies assessing the accuracy of ultrasound for detecting meniscal damage, it appears to be a potentially useful diagnostic test with reported sensitivity varying from 82–95% and specificity from 82–93% when compared to arthroscopy or arthrotomy findings. Experience of the ultrasonographer is also likely to be an important factor to consider.

Clinical Scenario

In dogs which have clinically suspected stifle or meniscal pathology, surgical arthrotomy or arthroscopy is often used to evaluate (and treat if indicated) meniscal disease. In those dogs without meniscal pathology, this surgical exploration could be avoided (provided there are no other indications for surgical intervention) if a noninvasive, alternative test could be used. Ultrasonography of the menisci is well described, however, this is not currently widely utilised as a diagnostic test. Given the potential use of ultrasound for this purpose, it is important to know the accuracy of its use as a test for meniscal damage, more precisely the sensitivity and specificity.

Summary of the evidence

| Arnault et al. (2009) | |
|------------------------------|---|
| Population: | Dogs with clinically suspected partial or complete cranial cruciate ligament rupture |
| Sample size: | 13 dogs |
| Intervention details: | <ul style="list-style-type: none"> • Ultrasound performed within 2 days prior to arthrotomy. • 8–16 MHz linear transducer used by experienced ultrasonographers. • Examination of menisci was performed in three longitudinal planes – cranio-abaxial, abaxial and caudo-abaxial approaches. • Other views were performed to image other aspects of the stifle. • At arthrotomy, surgeons recorded a visual assessment of the joint. They were blinded to the ultrasound findings. |
| Study design: | Prospective, cross sectional study |
| Outcome studied: | <ul style="list-style-type: none"> • Sensitivity, specificity, positive and negative predictive values of ultrasonography for detection of meniscal lesions and of meniscal clicking as a sign of a meniscal tear. |

| | |
|--|---|
| | <ul style="list-style-type: none"> • Diagnostic accuracy of cranial cruciate ligament rupture diagnosed by ultrasound. • Correlation of ultrasonographic vs. surgical osteophyte score (method of scoring not explained). |
| Main findings: (relevant to PICO question): | Sensitivity, specificity, positive and negative predictive values of ultrasonography for detection of meniscal lesions were 82%, 93%, 90% and 88% respectively. |
| Limitations: | <ul style="list-style-type: none"> • Small sample size. • Lack of normal controls. • All dogs were suspected clinically of cranial cruciate ligament rupture so were not a normal population. • Arthrotomy used as gold standard comparison however arthroscopy would have been more sensitive. • Some meniscal lesions may have been missed at surgery due to using only a craniolateral approach for arthrotomy. • Surgeons were blinded to imaging results but not to clinical examination findings. |

| Franklin et al. (2017) | |
|--|---|
| Population: | Dogs with clinically suspected partial or complete cranial cruciate ligament rupture |
| Sample size: | 26 dogs |
| Intervention details: | <ul style="list-style-type: none"> • Orthopaedic examination was performed. • 5T MRI was performed of the medial menisci. These were reviewed by a blinded radiologist. • A 5–18 MHz linear array probe was used by one surgeon to conduct an ultrasound examination evaluating cranial, middle and caudal aspects of the medial meniscus. Menisci were graded on the ultrasound findings. • Arthroscopy was then performed. • Surgical treatment for cranial cruciate rupture/meniscal damage was performed as necessary. • The arthroscopy was recorded and then reviewed retrospectively by the operating surgeon and another surgeon working independently, who was blinded to all other results. • Meniscal lesions were graded as surgical or not across ultrasound, arthroscopy and MRI examinations. |
| Study design: | Prospective, cross sectional study |
| Outcome studied: | Sensitivity, specificity and correct classification rate for detection of surgical medial meniscal disease of meniscal click, pain on flexion, ultrasound and MRI findings compared to arthroscopy |
| Main findings: (relevant to PICO question): | Sensitivity and specificity for detection of surgical medial meniscal disease using ultrasound was 95% and 82% respectively when compared to arthroscopy findings. Sensitivity and specificity data was based on: |

| | |
|---------------------|--|
| | <ul style="list-style-type: none"> • Correct detection of surgical disease in 19/20 stifles for surgeon one. • Correct categorisation as non-surgical menisci in 9/11 stifles for surgeon one. • Correct detection of surgical disease in 19/20 stifles for surgeon two. • Correct categorisation as non-surgical menisci in 7/11 stifles for surgeon two. |
| Limitations: | <ul style="list-style-type: none"> • Small study size. • Lack of normal controls. • Medial menisci assessed only. • The main surgeon had limited experience with ultrasonography of the stifle and was not blinded to the physical examination findings. • The same surgeon that performed the ultrasound performed the arthroscopies so was not blinded. • Criteria for surgical vs. non-surgical lesions was defined for the study there are no references for the basis of this criteria. |

| Mahn et al. (2005) | |
|--|--|
| Population: | Dogs admitted for evaluation of joint disease localised to the stifle. They also had to have a presumptive clinical diagnosis of meniscal pathology, an ultrasound examination and arthroscopy of the affected joint. |
| Sample size: | 12 joints across 10 dogs |
| Intervention details: | <ul style="list-style-type: none"> • Ultrasound was performed using a 12–14 MHz probe by a blinded ultrasonographer. • Imaging of the medial and lateral menisci were performed in three regions: cranial, middle and caudal. • Arthroscopy was performed within 48hrs of the ultrasound by one surgeon blinded to the ultrasound results. A retractor was used through a separate portal in some dogs to maximise visualisation of the menisci. • Any abnormalities were recorded and surgical treatment was carried out as felt necessary by the surgeon. • Data from the two diagnostic methods were compared by two investigators using the arthroscopy results as the gold standard. |
| Study design: | Prospective cross sectional study |
| Outcome studied: | Sensitivity, specificity, positive and negative predictive values of ultrasound for meniscal lesions when compared to arthroscopy findings |
| Main findings: (relevant to PICO question): | Sensitivity, specificity, positive and negative predictive values of ultrasound for meniscal lesions when compared to arthroscopy findings were 90.0%, 90.2%, 90.0% and 92.9% respectively |

Limitations:

- Small study size.
- Lack of normal controls.
- Arthroscopy surgeon not blinded to clinical findings.
- Experience of ultrasonographer not commented on so is unknown.

Appraisal, application and reflection

The original literature search revealed that there are several examples in the literature and books detailing how to perform an examination of the menisci however there were only three papers which assess this for suitability as a diagnostic test by evaluating sensitivity and specificity.

All papers were prospective cross sectional studies however, and used small numbers of dogs. The population across all three papers consisted of dogs with clinically suspected stifle disease or cranial cruciate ligament rupture and there were no normal dogs available as control subjects in any paper.

Arnault et al. (2009) assessed the use of ultrasound for general stifle lesions against arthrotomy findings. They reported a sensitivity and specificity of 82% and 93% respectively for ultrasonography in the detection of meniscal lesions by experienced ultrasonographers. One limitation of this study when compared to the others is that arthrotomy was used as the gold standard test. Within the discussion the authors comment on and reference the point that arthroscopy is more sensitive and hence would have made for a more suitable gold standard comparison. They also comment further that some meniscal lesions may have been missed at surgery due to their use of solely a craniolateral approach to arthrotomy, which may not allow visualisation of the entire meniscal surfaces. The study was partially blinded in that the imaging results were unknown to the surgeon although there would likely be some degree of bias because the surgeons were aware of the history and clinical examination findings of the dogs.

Franklin et al. (2017) investigated the use of stifle ultrasonography and also MRI for detection of surgical medial meniscal lesions when compared to arthroscopic findings. They reported a sensitivity and specificity of 95% and 82% respectively for ultrasonography in detection of medial meniscal lesions. One flaw in this study was that a surgeon with limited experience of stifle ultrasonography performed the ultrasound examinations. The same surgeon that performed the ultrasound also performed the arthroscopy afterwards and so could be biased with regard to the results. The statistics in this study were performed on the basis of whether a meniscus was surgical rather than if any lesion was present. The specific list of pathological changes which constituted a surgical or non-surgical meniscus was created for this study rather than being based on specific literature, so it may not be directly comparable across studies. Only medial menisci were evaluated in this study, likely because of the majority of meniscal disease to be medial, however it would have been ideal to include both menisci to increase overall number of menisci scanned in the study and to assess for differences in scanning difficulty or findings.

Mahn et al. (2005) also evaluated ultrasound as a diagnostic test as compared to arthroscopic findings. They reported a sensitivity and specificity of 90% and 90.2% respectively for ultrasonography in the detection of meniscal lesions. The surgeon for the arthroscopy was not blinded to the clinical findings so there may be some bias, as seen in the other papers. The experience of the ultrasonographer in this paper was not commented on so is unknown. During the arthroscopy an extra retractor was utilised through a separate port when necessary to maximise visualisation of the menisci which could have aided in lesion detection when compared to the use of a standard arthroscopy technique.

Overall the reported sensitivity varies from 82–95% and specificity from 82–93%. All three papers used high frequency probes for the assessment, which is likely to be an important prerequisite for general lesion identification. They also used cranial, middle and caudal views together for full assessment of the menisci. Two of the papers (Arnault et al., 2009; Franklin et al., 2017) comment on the difficulty involved with stifle ultrasonography and interpretation, therefore the sensitivity and specificity of using ultrasound as a diagnostic

test for meniscal damage is likely to be heavily reliant on the experience of the ultrasonographer.

In summary, although there are few studies evaluating the subject, the use of ultrasound for identification of meniscal lesions appears to have good sensitivity and specificity in populations of dogs with suspected stifle disease. It is likely to be a useful diagnostic test however experience of the ultrasonographer may be an important factor to consider.

Methodology Section

| Search Strategy | |
|---------------------------------------|--|
| Databases searched and dates covered: | CAB Abstracts via the Ovid platform, covering from 1973 to 2018 Week 19. Medline via the Ovid platform, covering from 1946 to 2018. |
| Search terms: | (Dog* OR bitch* OR canine*) AND (menisc* OR stifle) AND (ultra*) AND (damage* OR lesion* OR trauma* OR tear OR injur* OR pathol*) |
| Dates searches performed: | 21/05/2018 |

| Exclusion / Inclusion Criteria | |
|--------------------------------|--|
| Exclusion: | Articles not available in English, single case reports, book chapters, conference proceedings, articles which did not answer the PICO question and literature reviews. |
| Inclusion: | Articles available in English which were relevant to the PICO. Articles had to involve more than one animal. |

Please add rows as necessary

| Search Outcome | | | | | | |
|---|-------------------|------------------------------------|---------------------------|-------------------------------|---|-----------------------|
| Database | Number of results | Excluded – did not answer the PICO | Excluded – not in English | Excluded – irrelevant to PICO | Excluded – Conference Paper/Book/Review | Total relevant papers |
| CAB Abstracts | 34 | 7 | 9 | 9 | 7 | 2 |
| Medline | 25 | 3 | 5 | 13 | 1 | 3 |
| Total relevant papers when duplicates removed | | | | | | 3 |

CONFLICT OF INTEREST

The author declares no conflicts of interest.

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