FOUR LEG NEWS

September-October 2020 ~ Volume 9: Issue 5

OUTCOME MEASURES: PRESSURE ALGOMETRY

This edition of the Outcome Measures Series, features PRESSURE ALGOMETRY. This is a little known, and lesser talked about outcome tool, however, it does show some promise clinically. The line-up of articles presented here vary in the purpose of their study. Not all of them were clinically relevant. Some of them highlighted how NOT to use it clinically. Yet, I saved the two best for last – clinical studies, with clinical application, that validate not only the tool, but other physical therapeutics as well! Enjoy the learning!

Cheers! Laurie Edge-Hughes, BScPT, MAnimSt, CAFCI, CCRT

INTRODUCTION – WHAT IS PRESSURE ALGOMETRY?

Mechanical threshold testing (MTT) / Mechanical Nociceptive Testing (MNT) / Pressure algometry (PA) can quantify nociceptive thresholds in animals by measuring the extent of a mechanical stimulus to evoke a response. Algometry is the use of mechanical pressure to potentially identify abnormal pain thresholds and subsequent response to analgesic treatment. It is commonly done by using a blunt probe perpendicular to the skin over the area being tested. In animals, the stopping point is defined by behavioral signs suggesting that the stimulus is aversive. This is most likely due to first pain rather than maximum tolerated pain. These responses included pupil dilation, breath holding, skin twitching, head turning, vocalization, attempting to bite, and withdrawal movements. The use of algometry in dogs has not been fully evaluated for the assessment of somatosensory processing changes associated with chronic pain.

QUANTITATIVE SENSORY TESTING IN DOGS – IS IT A TOOL TO IDENTIFY CENTRAL SENSITIZATION?

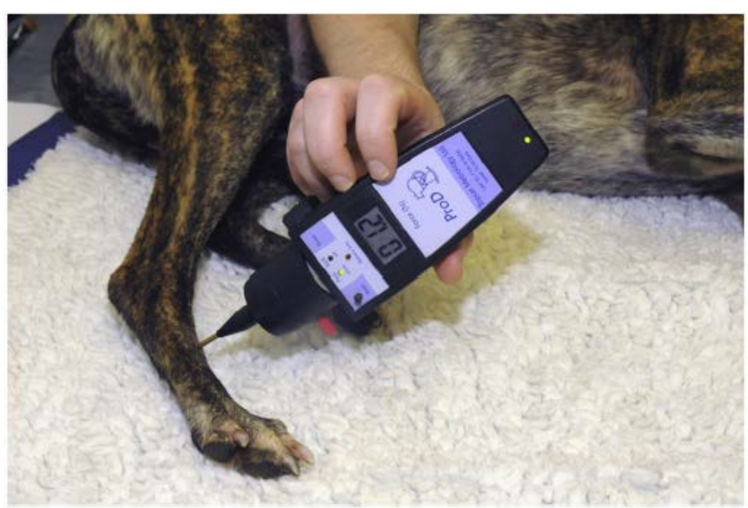
Hunt J, Knazovicky D, Lascelles BDX, Murrell J. Quantitative sensory testing in dogs with painful disease: A window to pain mechanisms?. Vet J. 2019;243:33-41.

Introduction: Quantitative sensory testing (QST) is the evaluation of the response to externally applied physical stimuli and it is used to provide important information regarding the functioning of the sensory systems. The stimuli are of graded intensity applied as a fixed or ramped stimulus, with a behavioral response being the end-point.

Considerations and challenges: An observer must infer, from behavioural cues, the point during the test at which the dog responds to the stimulus. It is possible that different animals will respond differently to different perceived intensities. It may also be that the testing protocol itself can provoke a response in some animals. Application of probes without a stimulus has been described in order to acclimatize dogs to the testing protocol. It is clear that number of sites tested, and order of testing, have an effect on responses but as of yet, no studies have been performed to determine the optimum number of sites that can be tested. In the authors' experience, 6 testing sequences is towards the maximum tolerated by most dogs without a prolonged break.

When performing QST, the test stimulus should be reliable and easy to apply to the designated site. Selection of the testing site is based on experimental design of the study, and it is recommended to
clip hair from the sites of testing. Primary lesion algoplasticity, indicative of changes to predominantly peripheral processing, can be assessed proximate to a wound or lesion, within the zone of inflammation. Secondary changes in sensitivity, more indicative of central changes, are assessed at sites outside the zone of inflammation, although the reaction at these sites may reflect states of generalized changes in peripheral sensitivity. A well distinguished end-point of the stimulus must be defined during the testing for each individual due to individual variability in responsiveness and behavioral reactions. Every stimulus modality should have defined cut off value to prevent tissue damage.

No studies have been published which explicitly investigate effects of the environment on the feasibility of testing, or on the measurements obtained, therefore the utility of QST as a clinical tool in a general veterinary environment is untested.



While laboratory-bred animals may be a suitable population for the determination of the accuracy and functioning of an apparatus, the lack of variability within the population will not enable an assessment of individual factors which affect QST measures. Assessment of such individual factors can be enabled by recruitment of a wide range of ages, breeds, weights, and sexes of dogs.

Modalities: *(Note: I have limited the reporting in this section to mechanical stimulus only. – LEH)*
Mechanical stimuli
Deep pressure pain is a noxious sensation transmitted by Cfibres in tissues deep to the skin, and is assessed using a blunt tipped algometer. The area over which force is applied affects the threshold, with smaller contact areas providing lower and less variable thresholds. One recommendation to maximise repeatability is to utilise a tip diameter which produces a mechanical nociceptive threshold of 4–6 Newtons in normal animals. The majority of studies suggest that repeatability is good for determination of deep pressure pain thresholds in dogs.

Interpretation of repeatability in dogs that may have somatosensory changes associated with a painful disease may be hampered by changes in the severity of disease over time, so demonstration of repeatability in such populations may require correlation of thresholds with measures of disease severity. According to current knowledge, QST should be undertaken in a room as free from distractions such as visual or auditory stimuli outside the room and odours. An acclimatization period should be observed before testing, and the environment kept constant.

Conclusion: Identification of an individual with altered somatosensory processing compared to the population distribution in the clinic is not currently possible using QST methodology, therefore these techniques cannot replace any currently used assessment tools. However, tracking of an individual animal's parameters over time may have merit; the likelihood of obtaining useful data can probably be maximized by the same individual performing testing in the same environment at the same time of day.

Knazovicky D, Helgeson ES, Case B, Gruen ME, Maixner W, Lascelles BD. Widespread somatosensory sensitivity in naturally occurring canine model of osteoarthritis. Pain. 2016;157(6):1325-1332.

In this study, quantitative sensory testing (QST) was performed on dogs with and without spontaneous hip or stifle osteoarthritis (OA) to determine whether OA is associated with central sensitization (CS). Mechanical (von Frey with a 0.5 mm tip and blunt pressure with a 3-mm tip) and thermal (hot and cold) sensory thresholds obtained in 31 dogs with chronic OA-associated pain were compared with those of 23 normal dogs. Dogs were phenotyped and joint-pain scored, and testing was performed at the OA-affected joint, cranial tibial muscle, and dorsal metatarsal region. The presence of OA was strongly associated with hyperalgesia across all QST modalities at the index joint, cranial tibial muscle, and metatarsal site. Mechanical QST scores were significantly moderately negatively correlated with total joint pain scores. The spontaneous canine OA model is associated with somatosensory sensitivity, likely indicative of CS.

Laurie's Comments: My take-away from these two papers, is "No. Pressure algometry and other quantitative sensory testing measures do not adequately provide data on whether an animal has altered sensory processing and/or central sensitization." However, as you will see in the upcoming papers, perhaps we can use it as a tool to evaluate treatments. Keep reading to learn more!

FEASIBILITY, REPEATABILITY, & RELIABILITY

(Note: **Feasibility** describes how easy or difficult it is to **do** something. When you set a goal at work, think about the long-term **feasibility** of accomplishing what you want.)

Briley JD, Williams MD, Freire M, Griffith EH, Lascelles BD. Feasibility and repeatability of cold and mechanical quantitative sensory testing in normal dogs. Vet J. 2014;199(2):245-250.

Spoiler alert! The cold testing was feasible but did not provide reliable results… so I took it out of the review. Additionally, I took out the info on the Electronic von Frey anesthesiometer, because we're not going to use that clinically. So, what remains is the pressure algometry information! - LEH

Introduction: This study aimed to assess the feasibility and inter-session repeatability of mechanical sensory thresholds using a blunt-probed pressure algometer (PA).

Materials and methods: Dogs were evaluated at two appointments, 2 weeks apart. To begin data collection, dogs were placed in lateral recumbency with minimum restraint on a house rug. For measurements on the left pelvic limb, dogs were placed in right lateral recumbency, and vice versa.

The PA (3 mm tip) was applied perpendicular to the dorsal surface of the metatarsus, between metatarsal bones III and IV, midway between the tarsometatarsal and metatarsophalangeal joints. The operator saw the force value only after a behavioral response occurred. Five trials per limb with 1 minute of rest in between was performed.

The end-point was defined as a deliberate movement of the limb, turning to look at the site, vocalization, or when the maximum force of the instrument was reached. Each dog was assigned a feasibility score that described the ease with which data could be collected per device; with scores ranging from 0 to 2 'easy data collection' and those from 3 to 5 'difficult data collection'. Dogs scoring higher than 2 did not return for the second evaluation and their data were excluded from analysis.

To be included in the study, dogs had to be older than 2 years of age and weigh between 10 and 40 kg. The dogs needed to be pain free and have a high quality of life as determined by the Canine Brief Pain Inventory (CBPI) and had to be judged by the examiner to be free of orthopedic, neurologic or other systemic disease, and not be receiving anti-inflammatory or analgesic drugs.

Results: Twenty-four normal, client-owned dogs were used. The median CBPI scores for both appointments were 0 (pain intensity), 0 (pain interference) and 5 (quality of life).
Feasibility scores for mechanical quantitative sensory testing (QST) at the first appointment for all 24 dogs were 20 scoring 0–2 (easy) and 4 scoring 3–5 (difficult). So, the 4 difficult dogs did not return. At the second appointment, all 20 dogs evaluated had feasibility scores of 0–2.

Discussion: The subjective feasibility scores in this study suggest that the QST protocol represents a feasible tool for somatosensory assessment in at least 79% of dogs. We have found that dogs with orthopedic or neurologic issues may have trouble standing or sitting/rising repeatedly so lateral recumbency is more suitable for QST.

Mechanical sensory thresholds had significant positive correlations with weight. Given the relatively low correlation coefficients, the current data do not support scaling thresholds to bodyweight. A correlation was found between age and PA sensory thresholds, with older dogs exhibiting increased sensitivity to stimuli. This relationship should be kept in mind as a confounding variable in future QST studies.

Given that a large proportion of the variance was due to differences among dogs, it is challenging to establish normative data ranges of sensory thresholds without a much larger sample size. **Since mechanical QST repeatability was good within individual dogs, these results are supportive for the use of intra-individual reference data in patients for clinical evaluation of sensory function over time.**

Conclusions: Pressure Algometry tested here was highly feasible and provided repeatable, reliable sensory threshold measurements in normal, client-owned dogs.

Ruel HL, Watanabe R, Evangelista MC et al. Feasibility and reliability of electrical, mechanical and thermal nociceptive testing and assessment of diffuse noxious inhibitory control in dogs. J Pain Res. 2018;11:2491-2496.

Note: This study also measured thermal nociceptive testing, but the results were not analyzed due to inconsistent results. So, I am removing mention of it in this review. - LEH

Introduction and Methods: This study aimed to evaluate the feasibility and reliability of electrical (ENT), and mechanical (MNT) nociceptive testing as well as the effect of a conditioning stimulus on MNT by using sixteen healthy client-owned dogs.

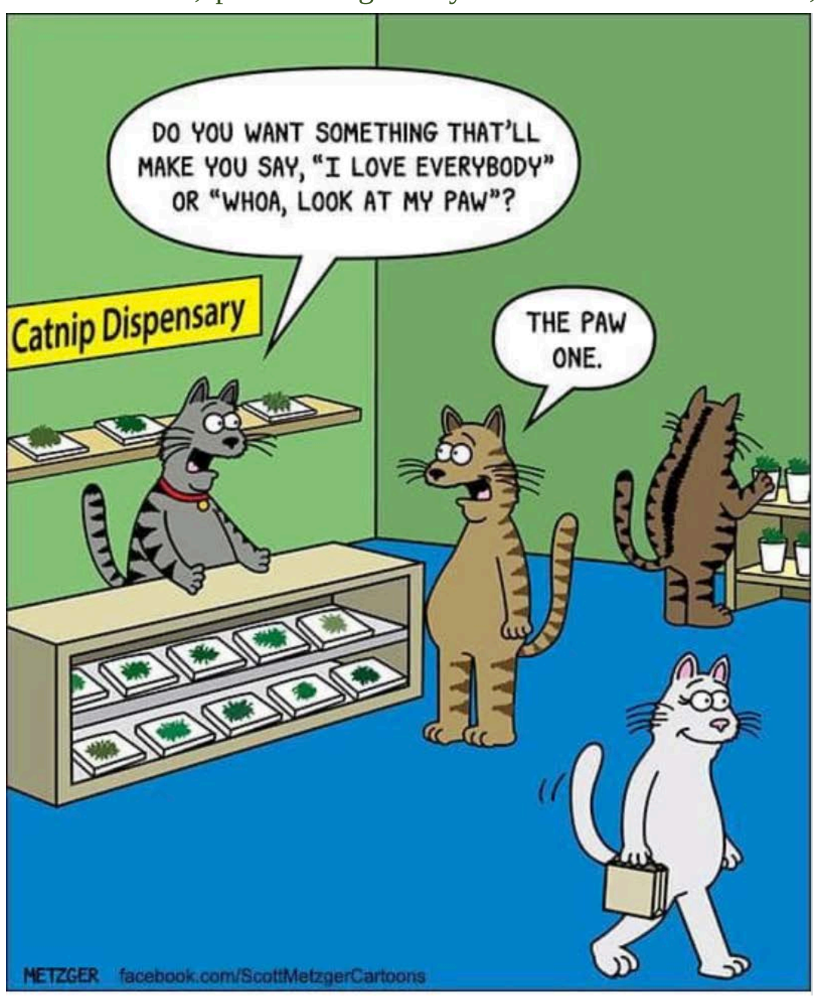
Stimulation was applied bilaterally to the dorsal and plantar aspect of the metacarpus and metatarsus, using transcutaneous electrical stimulator and pressure algometry in a randomized order until a behavior response or a cut-off point occured. Tests were performed twice one minute apart by two observers and again five hours later.

The diffuse noxious inhibitory control (DNIC) was tested by comparing MNT pre- and postconditioning stimuli. A neonatal blood pressure cuff was placed over the thoracic limb to be tested and inflated up to 200 mmHg for 60 seconds. The pressure was released and MNT was recorded 3 minutes later. This test was not randomly allocated and was performed last in all dogs to avoid interference with other nociceptive testing.

Results: Feasibility was 99% (ENT), and 93.5% (MNT). MNT was higher for thoracic than for pelvic limbs. Conditioning stimulus increased MNT. Inter observer reliability was 91.4% (ENT) and 60.9% (MNT). False-positive responses were 15% (ENT).

Conclusion: ENT was feasible, repeatable and superior to MNT. The assessment of the diffuse noxious inhibitory control with a conditioning stimulus showed promising results in dogs. These tools could be used in naturally-occurring disease to provide insight on their underlying mechanisms and therapeutics.

Laurie's thoughts: I have to admit, I am unsure the value of the 'diffuse noxious inhibitory control' test in the second study. How is that helpful? Does it have clinical relevance? I can't come up useful answers to those questions. However, could they have been unwittingly performing "Blood Flow Restriction Training"… and seeing a response? Perhaps! Hmm… maybe they tested a therapy without even knowing it! Okay… but back to this subtopic of FEASIBLITY, RELIABILITY, and REPRODUCIBILITY. So, pressure algometry does seem to be feasible, reproducible, and reliable. However, the studies indicate that bigger dogs tended to have higher MNT scores, and older dogs had lower MNT scores. So, again, what does this tell us? It says that we cannot use this device to effectively compare MNT scores between dogs… however it could be an outcome measure for intra-dog testing.



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Learning Confounds

Coleman KD, Schmiedt CW, Kirkby KA, et al. Learning confounds algometric assessment of mechanical thresholds in normal dogs. Vet Surg. 2014;43(3):361-367.

Introduction: We aimed to assess a force-recording-instrument at selected sites which correlate with common surgical sites and test for the effects of order of testing as well as test repeatability within and between days.

Material and Methods: Twenty skeletally mature client-owned retrievers or retriever mix dogs were recruited and each owner completed the Canine Brief Pain Inventory (CBPI). Dogs were excluded from the study if orthopedic or neurologic abnormalities were identified, if they had undergone recent surgery, if the CBPI score was more than 0, or if they were uncooperative during data collection.

Sites included five common orthopedic and one neurologic surgical sites bilaterally, marked with tape for consistency: 0.5cm distal to each epicondyle of the humerus; Medial and lateral to the patellar tendon; 0.5cm craniodorsal to each greater trochanter (over the piriformis muscle), and; 2cm lateral to (each side) of the spinal midline at the level of the thoracolumbar junction

Prior to testing, each dog was positioned in right lateral recumbency and acclimated to the quiet room for a few minutes. The algometer with a 1 cm diameter circular rubber tip was positioned perpendicular to the skin at each site and pressure was applied at a rate of approximately 8.9 N/s. The test stopped when a behavioral response was observed, which was defined as the mechanical nociceptive threshold. A positive response was determined to have occurred by mutual agreement of the 2 investigators present. Dogs were tested in the morning and evening of a single day; and repeated 10–14 days later, allowing 4 separate data collections for each dog. All algometric pressure testing was performed by the same blinded investigator; the algometer's console was secured to the investigator's wrist with the digital analog screen facing away from the investigator's view.

Results / Discussion: Twenty skeletally mature retriever or retriever mix dogs (age range 1.33–9 years, weight range 24–38.5 kg) were studied. There were 9 spayed females, 8 neutered males, and 3 intact male dogs. All dogs had normal orthopedic and neurologic examination findings and a CBPI score of 0/100. One dog had elective surgery after the first day, so this data was excluded.

We found significant variability in response to pressure algometry both within and between individual dogs. **The significant effects of order, site, site-order, time, and day on these data suggest that learning and anticipation occurred.** The effect of day and time is of particular concern because when algometry is used, repeated measures over time are performed to assess the duration of sensitivity changes.

We found a significant effect of repetition, suggesting that repeated measures at the same site differed significantly; although our design was such that the second measure at a given site was only performed after all other sites had been tested.

Sites with relatively large amounts of overlying soft tissue tolerated higher forces as compared to sites without.

Based on the relationship "pressure equals force divided by area," it appears that the smaller the footprint of the device used, less force is required to generate an aversive response. This fact greatly impacts the interpretation of data between devices with differing footprints.

Intact males had the highest threshold for each site tested during the first repetition on the morning of the first day, with neutered males and females having progressively lower threshold values.

Our study was designed to look at the effects of several confounding factors on algometric readings and did not reflect the way in which algometry would likely be used. **In studies using algometry, each dog should serve as its own control to eliminate inter-dog variation and the number of sites tested should be minimized to eliminate the effect of site.**

Conclusion: We found that when performing algometry at potential surgical sites in normal dogs, there is a significant effect of confounding variables such as order, site, site-order, time and day. **We suggest that learning and anticipation occurred over time and had a significant impact on results**. It was also demonstrated that intact male dogs tolerated higher pressure thresholds than neutered males and spayed females. Future studies attempting to validate this method or use algometry as an outcome measure should take these factors into account in the design of the study.

Laurie's thoughts: Oh dear. Well from this study, the conclusion is that confounding variables really mess up the results. As a side note, I tried to use pressure algometry to detect piriformis pain in dogs with pelvis asymmetry (and presumed SIJ dysfunction) as a pilot project for my Master's Degree. I also found that dogs routinely anticipated the pressure and that the readings were all over the map. I decided not to study it further. However, keep reading the studies below, as I think that with modifications, it can be much more reliable of a tool.

Experimental Protocol for Mechanical Threshold Testing in Dogs

Harris LK, Murrell JC, van Klink EG, Whay HR. Influence of experimental protocol on response rate and repeatability of mechanical threshold testing in dogs. Vet J. 2015;204(1):82-87.

Introduction: The aim of the current study was to evaluate the effects of tip diameter in contact with the skin, rate of force application, position of dog during testing, and anatomical site of testing on three outcomes: the response rate of mechanical threshold testing (MTT), the repeatability of MTT, and mechanical thresholds (MT).

Materials and methods: Twelve healthy dogs were included: five females (two neutered) and seven males (three neutered) with a mean age of 5.3 years and weight of 20.6 kg. Body condition scores (BCS) ranged between 4 to 6 out of 9. Inclusion criteria were that subjects should not have any illness or injury likely to cause pain or affect normal behavioural responses, or be receiving analgesic medication.

MTs were measured in Newtons, using a handheld pressure algometer with interchangeable, hemispherical tips of 2, 4 or 8 mm diameter. The rate of application was kept constant by utilizing warning lights if the device changed by 0.5 N/s above or below the set rate.

Dogs underwent 12 randomly ordered study sessions, one for every combination of protocol factors 'tip', 'rate' and 'position'. Sessions were divided into three blocks and within each block the algometer was applied once to nine anatomical sites in a randomised order (R/L radius, R/L stifle, R/L stifle, R/L tibia, & sternum). There was a rest period between blocks to allow at least 15 min between tests at the same site. Each session lasted approximately 45–60 min.

All testing was carried out in the same room, in which dogs were acclimated for 5 min before data collection began. Dogs were verbally encouraged to sit or lie down on a fleece mat on the floor. When lying, dogs were positioned in lateral recumbency such that the limb to be tested was dorsal. Dogs were minimally restrained throughout the procedure.

Results: Overall, 3175/3888 tests (82%) resulted in a measurable response. (Unmeasured responses were due to aversion and no responses occurred when the MMT-maximum for the device was reached) 'Dog', itself, had the greatest effect on response rate, indicated by a strongly significant likelihood ratio, meaning that within-subject variability contributed significantly to variation in the model.

Tests using the 2mm tip resulted in proportionally less unmeasurable outcomes compared to tests using the 4 and 8 mm tips, but these differences were non-significant. The 2 mm and 4 mm tips were both significantly less likely to reach the cut-out force than the 8mm tip.

Tests in which the dog was sitting were less likely to result in unmeasurable outcomes than tests where the dog was lying down. There was no significant effect of position on the likelihood of a test reaching cut-out.

Rate of force application had no effect on the response rate of the tests.

The most common reason for unmeasurable outcomes was avoidance. A second logistic regression model was therefore run in which avoidance was separated from other reasons. **The position of the dog had a greater effect in the second model compared to the first, indicating that tests carried out with the dog in lying position were likely to be unmeasurable due to avoidance.**

Mechanical thresholds were not influenced by 'rate', 'position' or 'site'. Average MTs and standard deviations (SD) increased with tip diameter. 'Dog' had a significant effect on MT, and MTs increased with bodyweight and decreased with age. Although these correlations were significant, the strength of the associations was low.

Sex alone had no significant effect on MT, but neutered dogs of either sex had significantly higher MT. BCS and breed significantly affected MT. However, because of the small number of dogs in each category the biological significance of these findings was unclear.

There was no significant correlation between session order and MT.

Discussion: The most significant factor affecting MT and response rate, and the only factor to affect repeatability, was 'dog', which could be attributed to differences in individual temperament. It was noted that more hyperactive dogs were likely to avoid application of the algometer and were less willing to lie down and remain in that position.

The narrowest tip (2 mm) was associated with proportionally less unmeasurable outcomes, and significantly less tests reaching cutout than wider tips. These findings suggest that it may be advisable to avoid using wider tips.

Conclusions: This study indicated that tip diameter, position of dog during testing and anatomical site of testing may influence the efficacy of MTT. It is recommended that a 2mm tip be used with the subject in the sitting position, and that testing at the tibia is avoided with this algometer (Note: algometry at the tibia was less reliable, more sensitive, and harder to do in sitting). When comparing studies, tip diameter should be taken into account.

Laurie's thoughts: Interesting! So, sitting was a better position than lying down. That is a position that also gives dogs more choice, and subsequently could result in more relaxed and objective testing. Tip diameter is tough however, as it is very specific to the tool. The pressure algometer that I purchased for my research pilot project was a mechanical device and had a 1cm tip. (This is the one I purchased because the expense was mine to bear for the research and the electronic readers were too expensive for me at the time.) However, other studies found how to use a 1cm tip successfully. Perhaps we look to those for guidance.

MNT in dogs with hindlimb joint pain compared to normal

Harris LK, Whay HR, Murrell JC. An investigation of mechanical nociceptive thresholds in dogs with hind limb joint pain compared to healthy control dogs. Vet J. 2018;234:85-90.

Introduction and Methods: This study investigated the effects of osteoarthritis (OA) on somatosensory processing in dogs using mechanical threshold testing. A pressure algometer with a hemispherical tip 2 mm in diameter was used to measure mechanical thresholds in 27 dogs with presumed hind limb osteoarthritis and 28 healthy dogs. **Measurements were taken at the stifles, radii and sternum**, and correlated with scores from an owner questionnaire and a clinical checklist done by a veterinary surgeon. Severity of osteoarthritis was measured using scores from an owner questionnaire adapted from the Helsinki chronic pain index. Higher scores for both of these measures were interpreted as an indication of greater OA severity. For each application of the algometer, the tip was positioned in contact with the anatomical site and force was applied by pushing the algometer against the site perpendicularly to the skin surface. Force was stopped if the dog responded or the cut-off force was reached.

Results: The presumed OA and control dogs did not differ in weight or sex, but OA dogs were older. Although we aimed to recruit dogs with hind limb OA only, four dogs also expressed a pain response to manipulation of a forelimb. Twenty of the 27 dogs with OA exhibited pain on manipulation of the coxofemoral joint and seven exhibited pain on manipulation of the stifle.

Despite applying the algometer to each dog a total of 30 times, we could not always measure a MT; an average of 26 MT values were obtained per dog, representing a response rate of approximately 88%; 3% of tests reached the cut-out force, 6% were terminated because the dog was avoiding the algometer and 3% were terminated because the tip became dislodged.

Mechanical thresholds in dogs with OA differed only at the stifle joints from control dogs. Dogs with OA had higher checklist total scores and questionnaire total scores than control dogs.

Mechanical thresholds measured at the stifle correlated negatively with both the checklist and the questionnaire; *MTs measured at radii or sternum did not correlate with the questionnaire or checklist.* **Age correlated negatively with stifle MTs and positively with both the checklist and questionnaire scores,** which meant that it was difficult isolate the effect of OA on MT from the effect of age.
When the effects of age and weight were taken into account, dogs with OA had lower MTs at the stifle joints than healthy controls. In all other models, there was no effect of OA on MT In model 7, which included checklist total score as an independent variable and sternum MT as the dependent variable, age affected MT. In all other models only weight affected MT.

Conclusions: **Multiple regression models indicated that, when bodyweight was taken into account, dogs with presumed osteoarthritis had lower mechanical thresholds at the stifles than control dogs, but not at other sites.** Non-parametric correlations showed that clinical checklist scores and questionnaire scores were negatively correlated with mechanical thresholds at the stifles. The results suggest that mechanical threshold testing using a pressure algometer can detect primary, and possibly secondary, hyperalgesia in dogs with presumed osteoarthritis. **This suggests that the mechanical threshold testing protocol used in this study might facilitate assessment of somatosensory changes associated with disease progression or response to treatment.**

Laurie's thoughts: Okay, so this study proposes that sensory changes (as in central sensitization) can occur but that they are regionally specific. This is science that matters to verify that what we think to be true is indeed true. However, it doesn't help us in regards to using a pressure algometer clinically. So, really, this is just one of those articles that you put in the 'good to know' category.

Clinical Applications:

CANINE BACK PAIN

Lane DM, Hill SA. Pressure algometry measurement of canine muscular pain near the thoracolumbar junction: evaluation of a modified technique. Vet Anaesth Analg. 2016;43(2):227-234.

Introduction: The purpose of this experiment was to evaluate the utility of pressure algometry as a tool for measuring focal muscular pain in the anticlinal and cranial lumbar region of client-owned dogs with naturally occurring lameness with a modified technique to prevent associative learning.

Methods: Sixty-three client-owned dogs with a history of restricted comfort or mobility were selected for this study. Dogs were assigned to one of two groups: group A dogs (n = 22) were placed on a restricted exercise program, while group B dogs (n = 25) were placed on a restricted exercise program and were administered combined acupuncture and manual therapy treatment (CAMT). After data collection in groups A and B was complete, animals were recruited for a control group, C (n = 16), that had no exercise restriction or treatment. Algometry measurements were taken at eight locations in the anticlinal and cranial lumbar regions; and were performed on four occasions over 28 days using a technique intended to prevent the dogs from developing a learned apprehension response. Measurements from eight locations were pooled and analyzed for changes over time.

Results: Increases in mechanical nociceptive tests (MNTs) over time at all locations tested were identified in groups A and B. In group C there were no significant changes in MNT or evidence of a learned apprehension response.

Discussion: Coleman et al. (2014) found that repeated measurements of MNTs on normal dogs showed a consistent trend of decreasing values over a 14-day period and concluded that learned aversion occurred. **Several modifications were made in this study in an attempt to avoid learned aversion; owners were present, dogs were allowed to stand instead of being restrained, the algometer probe had a head area of 1.0 cm^2 and did not make an audible beep, and sites were tested in random order and not measured again until all sites were tested. Another potentially key difference was the addition of a ceiling pressure value, so that not every algometer application resulted in a nociceptive stimulus.** Since multiple methodological modifications intended to prevent learning effects were simultaneously introduced, it is not known which ones played a role in eliminating learning as a confounding variable.

The addition of two potentially therapeutic interventions, exercise restriction and exercise restriction coupled with CAMT, was associated with a rise in MNTs in this study. This suggests that group A and B dogs experienced increasing comfort in the region of the thoracolumbar junction as a result of the implementation of these treatments. Further research into the value of these therapies is needed to evaluate their effectiveness alone or in combination in treating dogs with anticlinal or cranial lumbar paraspinal discomfort.

Conclusion and clinical relevance: MNTs in dogs without exercise restriction or CAMT were consistently repeatable and unchanged over time, indicating that there was no learned apprehension response to pressure algometry using the modified technique. Therefore, the increasing MNT values with time in dogs administered exercise restriction with or without CAMT suggests improved muscular comfort of the thoracolumbar region. Algometry may be a valid measure of MNTs in the anticlinal and cranial lumbar regions and may serve as an objective or semi-objective measurement of muscular pain.

Laurie's thoughts: Lovely! A few things are important here. 1) Take not of the modifications that were made to minimize the learned aversion – These are clinically relevant. 2) Additionally, this study validates the use of combined acupuncture and manual therapy as a treatment for back pain! Bada-boom! Bada-bing! Great mileage for one study!

EQUINE BACK PAIN

Long K, McGowan CM, Hyytiäinen HK, Effect of caudal traction on mechanicalnociceptive thresholds of epaxial and pelvic musculature on a group of horses with signs of back pain, Journal of Equine Veterinary Science (2020), doi: https://doi.org/10.1016/j.jevs.2020.103197.

Introduction: There is a direct muscular attachment from the lumbar vertebrae to the caudal vertebrae of the tail in horses. Caudal traction is a commonly used manual therapy technique thought to provide pain relief in horses. The objective of this study was to determine if caudal traction has an effect on mechanical nociceptive thresholds (MNT's) in a group of horses with clinical signs of back pain.

Methods: Pressure algometry was used to measure MNTs of five bilateral anatomical sites in the epaxial and pelvic musculature of 11 horses referred to physiotherapy due to clinical signs of back pain. Measurements were recorded both pre- and immediately post-traction with a calibrated pressure algometer (1cm^2 rubber tip) applied at a constant speed, at a 90-degree angle. Pressure was stopped immediately on identification of a recognised behavioural response by an equine behaviourist.

Reactions included the 'pain face' response, skin twitches, eyes wide, ears back, moving away or tail swishing. A 10 second interval between each recording was allowed to limit adaptation or sensitisation to the measurement.

Results: A significant difference was identified between mean pre- and post-caudal-traction algometry measurements in all described sites. The percentage of MNT increase was highest in the thoracic region compared to the lumbar and the pelvic regions.

Discussion: The fascial structures can also transfer the effect of caudal traction further to the structures of the more cranial parts of the body. A previous study brought to consideration that the re-establishment of the sliding system achieved with fascial release may inhibit nociception due to the fascia's high innervation of autonomic fibres. Another study suggested that in addition to biomechanical mechanisms, a sequence of neurophysiological responses are initiated following mechanical force application possibly including peripheral, spinal cord or supraspinal mechanisms. Tail-pull traction could affect the horses' inflammatory mediators and peripheral nociceptors directly, or it could exert a direct effect on the spinal cord via bombardment with sensory input from muscle proprioceptors initiating a spinal mechanism.

Examiner competence, inter-rater reliability, rate of application and tip selection have been recognised as influential on accuracy. In our study, testing was conducted by one experienced examiner with a constant rate of perpendicular application at 1 kg/s. The horse was held in the same position for marking as when to be tested to counter the elastic nature of skin and minimise shifting of the marked sites. A fixed order protocol was adopted to reduce variability. An equine behaviourist was present to report when the horse showed more subtle responses. The pressure algometer was easy to use and tolerated well by the subjects. Testing was conducted in the horses' own quiet, relaxed home environment with restraint provided by the owner.

Conclusion: These results show an effect of caudal traction in increasing MNTs in the thoracolumbar and pelvic regions in horses.

Laurie's comments: Yes, this is equine, but like the Lane study above, it validates the algometry tool in a clinical application AND validates tail traction as well! I don't think it's much of a 'leap' to say that tail traction in a horse and tail traction in a dog would be quite similar! Hooray for validation of one of our manual therapeutic tools!

FINAL THOUGHTS

Well I might have to dig around and find my old pressure algometer after all! This could be a very useful tool to validate what we have seen clinically with manual therapy in particular! I did a wee search online to check out purchasing Pressure Algometer units. The one on Amazon only had one star reviews! So, check these out instead:

https://www.medoc-web.com/algomed
https://www.jtechmedical.com/products/algometry
https://www.prohealthcareproducts.com/pain-treatment/

(NOTE: This is not an endorsement for any of these, rather just some samples to look at for your own decision making!)

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Drop me a line! Send me your questions!

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