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RESEARCH PAPER

Pressure algometry measurement of canine muscular pain near the thoracolumbar junction: evaluation of a modified technique

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Abstract

Objective To evaluate the utility of pressure algometry for measuring muscular pain in dogs by using a modified technique intended to prevent the development of a learned apprehension response.

Study design Prospective randomized clinical trial.

Animals Sixty-three client-owned dogs with a history of restricted comfort or mobility.

Method Pressure algometry was used to measure the mechanical nociceptive threshold (MNT) in eight locations around the thoracolumbar junction. 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 third (control) group, C (n = 16), that had no exercise restriction or treatment. Algometry measurements 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 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.

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. Although further research is needed, use of this modified technique should improve the utility of pressure algometry for measuring muscular pain in dogs.

Keywords algometer, dogs, mechanical nociceptive threshold, pain, sports medicine.

Introduction

The ability to reliably quantitate or even semi-quantitate focal musculoskeletal pain in dogs would impart many benefits to both clinicians and researchers. A technique with this capability could be used to isolate regions of significant discomfort and determine the effectiveness of analgesic protocols by measuring postoperative discomfort

associated with a surgical incision, and serial measurements may detect clinical response to treatment over time during a rehabilitation therapy program.

Pressure algometry is a repeatable and reliable technique that is used to quantify focal musculoskeletal pain and subsequent response to therapy in humans (Fischer 1987; Antonaci et al. 1998; Frank et al. 2013). Use of pressure algometry has been examined in horses, sheep, pigs, and cattle (Haussler & Erb 2003, 2006; Haussler 2006; Varcoe-Cocks et al. 2006; Haussler et al. 2007; Sullivan et al. 2007; Stubsjoen et al. 2010; Di Giminiani et al. 2013; Raundal et al. 2014). This technique determines a patient's mechanical nociceptive threshold (MNT), the point at which an animal first demonstrates an adverse response to increasing focal pressure. Typically, MNTs are determined by applying a blunt probe perpendicular to the skin over a specific landmark and then slowly increasing pressure until discomfort is expressed. In humans this discomfort is communicated verbally, whereas in animals the observer monitors for species-specific signs of discomfort, aversion, or avoidance. MNT values are inversely proportional to the amount of pain at the location being tested.

Although algometry has been used for research in dogs, both to evaluate the effectiveness of analgesia and to assess comfort after stifle surgery (Sammarco et al. 1996; Conzemius et al. 1997; Lascelles et al. 1997, 1998; Moak et al. 2011), the authors found only one published reference that examined the repeatability and reliability of algometry values in dogs (Coleman et al. 2014). The authors of that paper concluded that 'learning and anticipation occurred over time and had a significant impact on results' (Coleman et al. 2014). They found that serial algometric readings taken from common surgical locations in normal dogs resulted in decreasing MNTs over time. Several suggestions were made regarding how future research might circumvent this learning to improve the repeatability and reliability of algometric measurements.

The behavior that Coleman et al. (2014) observed is an example of associative learning. When an organism makes a link between behavior and outcome that results from performing that behavior, associative learning is said to have occurred. The aversive stimulus of pressure from the algometer could result in the dog withdrawing from the pressure (or otherwise expressing discomfort), and the behavior of withdrawing (thereby removing the pressure) would subsequently be reinforced, making it more likely to occur in the future at increasingly lower pressures. A pattern of decreasing values over time without any increase in otherwise discerned discomfort would result if associative learning were the main influence on the MNT values observed.

The cranial lumbar and anticlinal vertebral regions are common locations for muscular discomfort in dogs and it was for that reason that these locations were selected for scrutiny in this study. It has been reported that most thoracolumbar intervertebral disc disease lesions are identified between the 11th thoracic and second lumbar vertebrae and it has been postulated that the reason this region experiences so much degenerative change is that the joint surfaces experience greater locomotory forces per unit area relative to the other regions of the vertebral column (Steinberg & Coates 2013).

The anticlinal vertebra is the vertebra that has a dorsal spinous process towards which the spines of all the other vertebrae are inclined. It is the transition point at which the caudally angled dorsal spinous processes of the thoracic spine convert to the cranially angled spinous processes of the lumbar spine. The 11th thoracic vertebra is often, but not always, the anticlinal vertebra (Baines et al. 2009). For the purposes of this experiment, the anticlinal vertebra was defined as the vertebra with a shorter dorsal spinous process relative to its neighbors, resulting in a palpable depression on the dorsal midline just cranial to the thoracolumbar junction.

A number of therapeutic options are used to address muscular pain, including acupuncture and manual therapy. Manual therapy is an umbrella term that includes chiropractic-style manipulations, physiotherapy-style mobilizations, stretching and massage. Acupuncture and manual therapy can be used concurrently, a technique referred to as combined acupuncture and manual therapy (CAMT).

Many textbook chapters have described and advocated the use of either acupuncture or manual therapy (McCauley & Glinski 2004; Sutton 2004; Geoff & Jull 2007; Souvlis 2007; Jurek 2013; Medina 2013), even though the underlying mechanism for these techniques has not been fully described. Manual therapy was initially thought to cause tissue changes, but these early mechanistic models are now being replaced with neurophysiologic ones that suggest central mediation of pain signals is the primary mechanism (Schmid et al. 2008; Bialosky et al. 2009). Acupuncture is thought to have both local and central effects, including activation of descending endogenous opioid pathways (Medina 2013).