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Original Research

Pressure Algometry in Icelandic Horses: Interexaminer and Intraexaminer Reliability

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ABSTRACT

Reliability of pressure algometry as an outcome measure in equine research and therapy needs to be studied. The aim of the present study was to establish interexaminer and intraexaminer reliability of pressure algometry in Icelandic horses and to determine reference mechanical nociceptive threshold (MNT) values for that particular breed. Another aim was to create cutoff values, for clinical monitoring of asymmetry in musculoskeletal sensitivity in the Icelandic horse. Nine clinically sound Icelandic horses were tested with a pressure algometer on 11 anatomic landmarks on the neck, back, and croup, each by two examiners. Three weeks later, the procedure was repeated. Interexaminer reliability was good (intraclass correlation [ICC] = 0.64; $P < .001$). Short-term intraexaminer reliability over three repeated measurements was comparable to other studies. Intraexaminer reliability over 3 weeks was moderate for examiner 1 (ICC = 0.46; $P < .001$) and good for examiner 2 (ICC = 0.78; $P < .001$). Measurements of examiner 1 differed significantly from those of examiner 2 ($P < .001$). For each anatomic landmark and examiner, mean MNT values (standard deviation) were calculated. Asymmetry values were calculated for bilateral anatomic landmarks. It was concluded that the reliability of pressure algometry in a population of sound Icelandic horses was moderate to good. Future research is needed to assess the interexaminer and intraexaminer reliability of pressure algometry in horses with musculoskeletal pain.

1. Introduction

Pressure algometry is a technique whereby an examiner increasingly applies pressure to soft tissue or bony anatomic landmarks, to determine the mechanical nociceptive threshold (MNT). The MNT is defined as the minimum pressure that causes a pain response [1], at which point the pressure is stopped. Higher MNT values are thus associated with reduced pain and lower values with an increase in painfulness or sensitivity [2]. Handheld pressure algometers (PAs), automated devices, cuffs, and an algometer fixation device (stand) are among the different types and procedures that are being used. Pressure algometry has shown to be a reliable and valid method to objectively assess musculoskeletal pain in humans; intraexaminer and interexaminer reliability are moderate to excellent, depending on the PA and procedure used [3–7]. Around the turn of the century, pressure algometry made its entrance in the field of equine research. It was welcomed as a potentially objective technique to assess nociception in the horse [8,9], as an outcome measure for various treatment modalities [10,11] and in experimental models on analgesics [12,13].

In equines, reliability of pressure algometry has mainly been defined by the short-term intraexaminer reliability of three repetitive measurements, taken at one site, with approximately 3 seconds in between [8,10,12,14]. The

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difference between the outermost MNT values is calculated and is termed the "range" over which the examiner measured MNTs at that site within 3 to 4 seconds. The values may increase from the first until the third measurement (this is taken to reflect habituation), decrease (this is taken to reflect sensitization to the measurement), or the values may show no specific pattern or be equal for the three measurements [8]. The ranges are averaged to calculate the "mean range," that is the general short-term reliability during a study. Intraexaminer reliability increases as the range over the three repeated measurements decreases. In contrast with short-term intraexaminer reliability, both intraexaminer reliability over a longer time-lapse and interexaminer reliability between two examiners have not yet been determined systematically in horses. Any examination or procedure viewed as reliable would need to produce similar results regardless of time, environment, or examiner [15]. For use in veterinarian and physiotherapeutic clinical practice, it is important to gain more insight in the interexaminer and intraexaminer reliability of pressure algometry [16]. To our knowledge, however, no study has explicitly determined interexaminer and intraexaminer reliability of pressure algometry measurements of the equine neck, back, and croup over a period of 3 weeks, while comparing two observers using a handheld PA. An examination interval of 3 weeks is commonly used in veterinarian and physiotherapeutic clinical practice.

Reference MNTs of sound horses provide a standard to which horses with suspected or known pain can be compared. Furthermore, subject status and breed appear to be of influence on MNT values. Clinical problems may also present as asymmetry in MNTs between left-sided and corresponding right-sided anatomic landmarks [8].

The aim of the study was to assess interexaminer and intraexaminer reliability of pressure algometry in Icelandic horses over a 3-week period and to determine reference MNTs for several clinically relevant anatomic landmarks. As a parameter for diagnosing and treating Icelandic horses with neck, back, and croup pain, we calculated cutoff values for asymmetry.

2. Materials and Methods

2.1. Ethical Approval

The study design was approved by the institutional Ethics Committee on the Care and Use of Experimental Animals in compliance with Dutch legislation on animal experimentation (2009.III.06.049).

2.2. Animals

Nine clinically sound Icelandic horses from one barn were tested, including four mares, four geldings, and one stallion. Mean (standard deviation [SD]) age was 13.3 (7.7) years, and mean (SD) height at the withers was 1.4 (0.04) m. Soundness was investigated by one of the examiners, an experienced animal physiotherapist (G.B.). The horses varied from being riding school horses (n = 4) to elite level Icelandic sport horses (n = 4). One horse was retired. The horses were all kept in the pasture with a shelter. Workload for the horses at the time of the study consisted of riding at their specific level, for approximately 1 hour a day, 5 days per week, except for the retired horse.

2.3. Pressure Algometer

A handheld PA with a 1-cm^2 tip and a range of 3 to 30 kg force/cm^2 was used (Wagner instruments, model FDK 60). In this model, the rate of building the pressure has to be controlled by the examiner. The maximum force applied during testing is retained by the instrument. Pressing a peak hold button resets the PA, so that the next MNT can be obtained.

2.4. Method

The horses were tested on 2 days, with 3 weeks in between. Mechanical nociceptive thresholds were determined at 11 anatomic landmarks (Fig. 1). These anatomic landmarks were adopted from Haussler and Erb [8] and de Heus et al [14], reflecting musculoskeletal sites that are reported to be frequently involved in musculoskeletal pain. The anatomic landmarks were marked with correction fluid. Two board certified animal physiotherapists applied the pressure, after practicing the use of the PA. A metronome was used for audible feedback on speed of application and was combined with visual feedback from the algometer, until a steady rate was accomplished. The examiners then practised together on recognizing local avoidance reactions on a horse not involved in the study. The pressure was increased gradually with approximately 3.3 kg force/cm^2/s until the horse displayed a local avoidance reaction like skin twitching, local muscular contractions, induced lordosis, or stepping away. The pressure was then stopped, and the corresponding value on the PA was noted by an assistant, to ensure that the examiners were blinded to the MNT values. In the case of technical failures during measurement, like slipping off anatomic landmarks or the horse being obviously distracted by an external stimulus, the specific MNT value was discarded and an extra measurement was obtained.

The physiotherapists, called examiner 1 and examiner 2 from now on, each tested the horses on all 11 anatomic landmarks. The horses were given a 15-minute break between the sessions of both examiners, during which they could rest in a stable. At each anatomic landmark, three consecutive measurements with the PA were taken, with approximately 3 to 4 seconds in between [8]. The examiners were both right handed and used their right hand in holding the PA. The order in which the examiners tested the horses was alternated. For the first horse, examiner 1 started with pressure algometry measurements, the second horse was first tested by examiner 2, the third by examiner 1, and so forth, to prevent an effect of starting order of examiners. On the second research day, examiner 2 started with pressure algometry measurements on the first horse, the second horse was first tested by examiner 1, and so forth.

To obtain MNTs of the bilateral transverse process of C5, the opposite transverse process of C5 was stabilized by the