



Review

Classification of involuntary movements in dogs: Tremors and twitches



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ABSTRACT

This review focuses on important new findings in the field of involuntary movements (IM) in dogs and illustrates the importance of developing a clear classification tool for diagnosing tremor and twitches. Developments over the last decade have changed our understanding of IM and highlight several caveats in the current tremor classification. Given the ambiguous association between tremor phenomenology and tremor aetiology, a more cautious definition of tremors based on clinical assessment is required. An algorithm for the characterisation of tremors is presented herein. The classification of tremors is based on the distinction between tremors that occur at rest and tremors that are action-related; tremors associated with action are divided into postural or kinetic. Controversial issues are outlined and thus reflect the open questions that are yet to be answered from an evidence base of peer-reviewed published literature. Peripheral nerve hyper-excitability (PNH; cramps and twitches) may manifest as fasciculations, myokymia, neuromyotonia, cramps, tetany and tetanus. It is anticipated that as we learn more about the aetiology and pathogenesis of IMs, future revisions to the classification will be needed. It is therefore the intent of this work to stimulate discussions and thus contribute to the development of IM research.

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Introduction

This work has been undertaken to create a common terminology and classification for involuntary movements (IM) in dogs. The frequency of IM in dogs is undetermined, although this may largely be due to under-recognition and lack of validation in the veterinary field. Classification systems are necessary to provide a framework for the study of aetiology, pathogenesis, and treatment of IM, and to facilitate recognition and diagnosis. The terminology used to classify IM has changed many times and continues to do so. The lack of a universally accepted terminology is an ongoing source of confusion. Despite attempts to simplify classification and unify terminology, as much controversy exists today as existed 30 years ago regarding appropriate definitions of IM (Cuddon, 1990; Bagley, 1991; Podell, 2004; De Lahunta et al., 2006).

This review is based on the assumption that different components of IM can be separated by clinical observation and need to be described with a common terminology (Abdo et al., 2010). To achieve this objective, the definition of some IM-related terms must first be clarified (Table 1).

Historically, IM are divided into their neuroanatomical location (Table 2). Sub-classification according to their association with

rest or action (e.g. tremors), frequency and amplitude of oscillatory movements (e.g. peripheral nerve hyperexcitability) or their phenomenological features (e.g. paroxysmal movement disorders and epileptic seizures) further define the movement (Deuschl et al., 1998). It is always the core feature of the movement disorder that should be defined and considered (Abdo et al., 2010), because many movement disorders can occur concurrently (Abdo et al., 2010).

Tremor

Tremor is an involuntary, rhythmic, oscillatory movement of a body part. It is the most common movement disorder encountered in the human field, but there is no diagnostic standard to distinguish between common types of tremors, which makes evaluation challenging (Deuschl et al., 1998).

Controversies

Veterinary reviews on tremor syndromes have been in agreement with regard to identification (Cuddon, 1990; Bagley, 1991; Podell, 2004; De Lahunta et al., 2006). The terms tremor and myoclonus were debated by one group who stated that the term 'myoclonus' should be used in place of 'tremor' (De Lahunta et al., 2006). This terminology was considered in human medicine but a consensus statement clarified that when the dominant feature of

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Table 1
Terminology used to describe involuntary movements.

Terminology	Definition
Athetosis	A prolonged, slow contraction of the trunk muscles resulting in bending and writhing of the body and precluding maintenance of a stable posture
Ballism	An abrupt contraction of the limb muscles which results in a flailing movement of the limb and is often unilateral
Chorea	An abrupt, unsustained contraction of different muscle groups
Choreoathetosis	Involuntary movements that have characteristics of both chorea and athetosis
Cramp	A sudden, severe, and involuntary muscle contraction or over-shortening that is generally temporary and benign
Dystonia	A sustained involuntary contraction of a group of muscles producing abnormal postures
Fasciculations	A brief spontaneous contraction affecting a small number of muscle fibres, often causing a flicker of movement under the skin
Myoclonus	A sequence of repeated, often arrhythmic, brief shock-like jerks due to sudden involuntary contraction or relaxation of one or more muscles
Myokymia	A focal or generalised continuous muscle contraction, often exhibiting an undulation of the skin overlying the affected muscle
Myotonia	A disturbance in muscle relaxation after voluntary contraction or percussion. It improves with continued activity
Neuromyotonia	A continuous spontaneous muscle activity characterised by muscle rippling, muscle stiffness, and myotonia
Stereotypies	Repetitive, simple movements that can be easily suppressed
Tetanus / Tetany	Sustained muscle contraction, usually the extensors, without relaxation
Tics	Repeated, individually recognisable, intermittent movements or movement fragments that are almost always briefly suppressible. In humans they are usually associated with awareness of an urge to perform the movement
Tremor	Involuntary, rhythmic oscillatory movements of a body part

the movement disorder is rhythmicity, it should be labelled as a tremor (Deuschl et al., 1998).

The term tremor is most often used to describe phenotypes of relatively pure forms of tremor, not associated with other neurological features and without evidence of pathological abnormalities. It is widely appreciated, however, that tremor occurs in a large proportion of patients with other clinical signs such as paroxysmal dyskinesia and peripheral nerve hyper-excitability (Balint and Bhatia, 2014). Bridging terms such as ‘orthostatic tremor plus’ have been introduced in the human literature to acknowledge specific syndromes in which tremor predominates but is combined with other neurological features such as myoclonus or dyskinesia, and in which there is an absence of neuronal degeneration (Mestre et al., 2012).

Identification

Identification of tremor can be difficult. The keyword in identification is ‘rhythmicity’; that is, oscillations occurring at a regular frequency. This in itself can be perplexing, as many tremors have variable amplitudes (e.g. intention tremors). Despite amplitude variance, tremor frequency remains unchanged (Deuschl et al., 1998).

Classification

Correct classification of tremor forms the basis for the subsequent diagnostic process. Because tremor has been classified in different ways, numerous tremor aetiologies mean a practical aetiological or a valid physiological classification is not available. An important method of classification in humans is based on the characteristic moment or situation of occurrence (Deuschl et al.,

Table 2
Anatomical classification of involuntary movements.

Anatomic site	Involuntary movement
Muscle	Myotonia Myotonic dystrophy Myokymia
Peripheral nerve	Neuromyotonia Cramp Fasciculations Tetany Tetanus
Central nervous system	Paroxysmal dyskinesia Myoclonus Hyperekplexia Hemifacial spasm Tremor

1998). Therefore, the tremor can be classified as resting or action-related. When action-related, this can be further divided into postural and kinetic. Resting tremors can be distinguished from other forms of tremor based on their occurrence when the tremoring body part is completely supported against gravity without voluntary muscle contraction. Action-related tremors include all tremor manifestations in body parts that are not at rest and comprise postural (occurring while maintaining a posture against gravity) and kinetic tremors (occurring during active movement). Kinetic tremors include task-specific tremors and tremors that are specific to goal-directed movements (intention tremors).

The reference standard for tremor research remains clinical classification (Abdo et al., 2010). We propose to classify tremors according to the traditional approach of clinical neurology, i.e. clinical features. Based on their specific clinical features, tremors are grouped into syndromes that can be separated on the basis of clinical observations alone. Our proposal for tremor classification in dogs, based upon the human system (Abdo et al., 2010), is summarised in Fig. 1.

Resting tremors

Resting tremor in humans is most commonly found in Parkinson’s disease, but seldom in other conditions (Abdo et al., 2010). It has been stated that most patients with a resting tremor will respond to dopaminergic treatment (Puschmann and Wszolek, 2011). However, exceptions have been found and so this is not included in the true definition of a resting tremor (Deuschl et al., 1998).

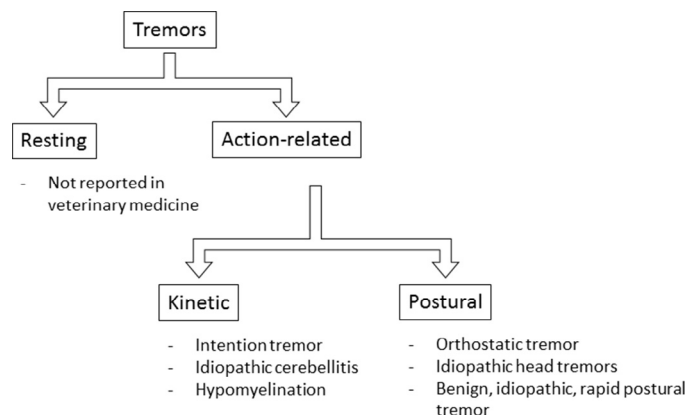


Fig. 1. Classification algorithm of tremor according to moment of occurrence.

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