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Review

Myoclonus in the critically ill: Diagnosis, management, and clinical impact ☆

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HIGHLIGHTS

- Recognizing different types of myoclonus in the critically ill is important to direct adequate treatment.
- Neurological injuries, anesthetics, and muscle relaxants interfere with the typical appearance of myoclonus.
- This review discusses clinical, electrophysiological, and neuroimaging features along with their prognostic impact and treatment options.

ABSTRACT

Myoclonus is the second most common involuntary non-epileptic movement in intensive care units following tremor-like gestures. Although there are several types of myoclonus, they remain underappreciated, and their diagnostic and prognostic associations are largely ignored.

This review discusses clinical, electrophysiological, neuroanatomical, and neuroimaging characteristics of different types of myoclonus in critically ill adults along with their prognostic impact and treatment options.

Myoclonus is characterized by a sudden, brief, and sometimes repetitive muscle contraction of body parts, or a brief and sudden cessation of tonic muscle innervation followed by a rapid recovery of tonus. Myoclonus can resemble physiologic and other pathologic involuntary movements. Neurologic injuries, anesthetics, and muscle relaxants interfere with the typical appearance of myoclonus. Identifying "real myoclonus" and determining the neuroanatomical origin are important, as treatment responses depend on the involved neuroanatomical structures. The identification of the type of myoclonus, the involved neuroanatomical structures, and the associated illnesses is essential to direct treatment.

In conclusion, the combined clinical, electrophysiological, and neuroradiological examination reliably uncovers the neuroanatomical sources and the pathophysiology of myoclonus. Recognizing cortical myoclonus is critical, as it is treatable and may progress to generalized convulsive seizures or status epilepticus.

Contents

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1. Introduction

Myoclonus is the second most common involuntary non-epileptic movement in intensive care units (ICUs) following tremor-like gesture (Benbadis et al., 2010). However, myoclonic jerks are not pathognomonic of any particular disease.

Despite the growing body of evidence that myoclonus accompanies a number of critical illnesses, it remains underappreciated and its diagnostic and prognostic impact is largely ignored.

The aim of this review was to provide a comprehensive overview of the clinical, electrophysiological, neuroanatomical, and neuroimaging characteristics of the different types of myoclonus in critically ill adult patients along with the prognostic impact in critical care and current treatment options.

2. Definition, phenomenology, and clinical classification of myoclonus

Myoclonus is a sudden, brief, abrupt twitching of body parts involving the face, extremities, and trunk (Fahn et al., 1986) caused by an abnormally increased excitability of neurons leading to muscle contractions (i.e., positive myoclonus), or a sudden brief loss of muscle tonus followed by a rapid recovery of tonus (i.e., negative myoclonus) that may appear in clusters called "flapping tremor" or "asterixis" (Fig. 1) (Artieda et al., 1992; Butz et al., 2014; Shibasaki, 1995; Young and Shahani, 1986). In some cases, myoclonus can be associated with epileptic events (Baumgartner et al., 1996; Belcastro et al., 2011; Meletti et al., 2000; Rubboli et al., 1995; Song et al., 2006; Tassinari et al., 1995). The study of myoclonus begins with the clinical observation and examination. Involved muscles, temporal distribution, synchronization, rhythmicity, periodicity, relation to motor activity, and stimulus sensitivity can be observed and categorized clinically, and it may direct diagnostic procedures for neuroanatomical and etiological categorization, which assists the choice of treatment (Shibasaki, 2002) (Table 1).

In addition, accompanying clinical signs, and specific electrophysiologic and neuroimaging patterns are important features that help consolidating the diagnosis.

3. Etiological classification of myoclonus

3.1. Symptomatic myoclonus in the ICU

A large variety of critical illnesses, medication, and illicit drugs may be associated with different types of myoclonus (Table 2).

Myoclonus can be triggered or aggravated by a large number of different drugs used in intensive care including opioids, such as hydromorphone (Babul and Darke, 1992; Patel et al., 2006), morphine (Potter et al., 1989), and fentanyl (Stuerenburg et al., 2000); nonsteroidal anti-inflammatory drugs (Bandelot and Mihout, 1978); neuroleptics (Pedavally et al., 2014; Strachan and Benoff, 2006; Vural and Tezer, 2012); antiepileptic drugs in high doses, such as carbamazepine (Magaudda and Di Rosa, 2012), oxcarbazepine (Fanella et al., 2013), lamotrigin (Algahtani et al., 2014), topiramate (Miller et al., 2010), pregabalin and gabapentin (Ege et al., 2008; Healy et al., 2009; Hellwig and Amtage, 2008), phenytoin (Duarte et al., 1996), and valproic acid (Gardner et al., 2009); antidepressants (Caviness and Evidente, 2003; Evidente and Caviness, 1999; Praharaj et al., 2010); the amino acid precursor of dopamine – levodopa (Yoshida et al., 1993) and bromocriptine

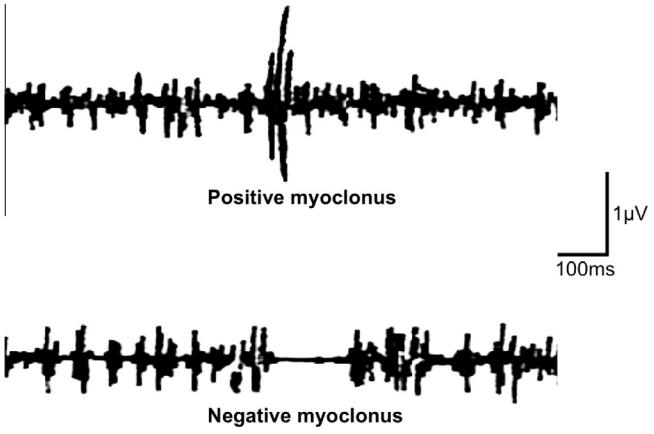

Fig. 1. Schematic illustration of electromyographic correlates of positive and negative myoclonus during sustained muscle contraction.

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