

Circadian Rhythm of Patients with Disorders of Consciousness



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Abstract

Patients with Disorders of Consciousness (DOC) exhibit arousal fluctuations, showing periods of circadian sleep-wake. Circadian rhythms are the outward manifestation of an endogenous timing system. The diagnosis of patients does not only rely on behavioral responsiveness during process, but also based on the rhythm of patients. Therefore, it is important to know the circadian rhythm of DOC patients. We also need to be aware of the importance of adjusting circadian rhythm for DOC patient in diagnosis and treatment.

Keywords: Disorders of consciousness, Circadian rhythm, Assessment, Arousal

Opinion

In recent years, the diagnosis and treatment of Disorders of Consciousness (DOC) have gained attention. DOC include the unresponsive wakefulness syndrome (UWS, formerly known as vegetative state) [1,2] and Minimally Conscious State (MCS) [3]. Both UWS and MCS patients exhibit arousal fluctuations, showing periods of eye-opening and eye-closing, which resemble circadian sleep-wake cycles (also known as circadian rhythms) [4]. However, the arousal fluctuations effect the diagnosis of behavioral assessment during Coma Recovery Scale-Revised (CRS-R, 'gold standard' for diagnosing DOC) process in clinic [5]. Therefore, we need to know that if all DOC present exhibit circadian rhythm and whether the evaluation of rhythm is crucial for all DOC patient before the CRS-R assessment.

Circadian rhythms are the outward manifestation of an endogenous timing system [6]. They are generated by the central endogenous clock that resides in the Supra Chiasmatic Nucleus (SCN) of the anterior hypothalamus [7,8]. The SCN synchronizes all the other intrinsic clocks and integrates information from the environment to form coherent rhythms that are near 24-h periods [9,10]. When periodic synchronizing cues from the environment are absent, the endogenous circadian rhythm (i.e., free-running rhythm) appears. This free-running rhythm deviates from its normal cycle and it is usually longer than 24 h, around 24.18 h [11-13]. In fact, circadian rhythms of electrophysiology, skin temperature, hormone secretion, as well as blood pressure and heart rate [14,15] have been observed in some patients with UWS and MCS. However, when exposing to monochromatic light

during night, MCS patients and healthy person displayed light-induced suppression of melatonin but patients in UWS didn't displayed it [16]. Since the hormone melatonin is considered to be the best circadian phase index, this finding indicates that environmental lighting may not influence the circadian rhythms in UWS patients.

A previous study examining circadian rhythm variables of 3 UWS patients', including systolic blood pressure, diastolic blood pressure and heart rate. The authors report circadian periods of 24.25 h, 24.18 h, and 24.14 h [15]. In studies on healthy participants where environmental cues were controlled, the circadian period changes to something close to the free-running period [11,17-19]. Then, can we say that UWS patients present free-running periods due to the lack of conscious awareness of the environment and MCS patients can be synchronized with the outside world and consequently form 24-h cycles? Several previous studies on other circadian rhythms seem in line with our opinion. Among all the external time cues, light is the most powerful one [20,21]. Normally, exposure to light at night suppresses melatonin secretion Guaraldi P et al [16]. investigated the light-induced melatonin suppression in a group of 6 UWS patients and 9 healthy volunteers, and found that in contrast to the controls, UWS patients displayed no significant changes of melatonin during light-exposure at night. Another study by De Weer AS et al [22]. evaluated environmental influences on circadian variations in motor patterns in 3 MCS and 1 comatose patient. They observed that motor activity was correlated with presence and actions of other persons in 2 traumatic MCS

patients. Furthermore, a recent study showed that arousal subscale scores of CRS-R were closely related to the circadian core body temperature variation, which provided evidence for their association between circadian body temperature rhythms and consciousness levels in DOC patients [23].

In conclusion, it suggests that a relationship between circadian rhythm and consciousness might exist. We all know that the CRS-R diagnosis of patients does not only rely on behavioral responsiveness during process, but also based on the rhythm of patients. It could therefore be a useful complement to behavioral diagnosis and decrease the rate of misdiagnosis. Moreover, it's necessary to assess the period of arousal before using CRS-R to assess the consciousness of DOC patients and the best time of the CRS-R evaluation can be chosen according to the patients' own rhythm due to the fluctuation of arousal.

Conflict of Interest

The authors declare that they have no any economic interest and any conflict of interest exists.

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