



## Case Report

# Cannabidiol can improve complex sleep-related behaviours associated with rapid eye movement sleep behaviour disorder in Parkinson's disease patients: a case series

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## SUMMARY

**What is known and objective:** Cannabidiol (CBD) is the main non-psychoactive component of the *Cannabis sativa* plant. REM sleep behaviour disorder (RBD) is a parasomnia characterized by the loss of muscle atonia during REM sleep associated with nightmares and active behaviour during dreaming. We have described the effects of CBD in RBD symptoms in patients with Parkinson's disease.

**Cases summary:** Four patients treated with CBD had prompt and substantial reduction in the frequency of RBD-related events without side effects.

**What is new and conclusion:** This case series indicates that CBD is able to control the symptoms of RBD.

## WHAT IS KNOWN AND OBJECTIVE

Cannabidiol (CBD) is the main non-psychoactive component of the *Cannabis sativa* plant. Several studies have shown that CBD has a broad spectrum of action that includes hypnotic, antipsychotic, anxiolytic and neuroprotective properties.<sup>1</sup>

There are few investigations about the effects of CBD on the sleep-wake cycle; however, CBD 160 mg/day was shown to significantly increase the quality of sleep, with subjective reports of increased total sleep time and lesser sleep fragmentation. Three doses of CBD (40, 80 and 160 mg/day) were shown to decrease dream recall and were not related to adverse effects on the following day.<sup>2</sup>

REM sleep behaviour disorder (RBD) is an increasingly recognized parasomnia characterized by the loss of muscle atonia during REM sleep associated with nightmares and active behaviour during dreaming. The study by Schenck *et al.*<sup>3</sup> was the first to report that patients with idiopathic RBD had high rates of conversion to pathologies related to the deposition of alpha-synuclein, especially Parkinson's disease (PD).

Nowadays, the pharmacological management of RBD is limited, as the main drug used to treat the condition is clonazepam, a

benzodiazepine with a long half-life. The use of benzodiazepines in elderly individuals is potentially problematic because of their adverse effects, which restrict the use of these drugs in patients with PD and RBD. Another drug used to treat RBD is melatonin,<sup>4</sup> despite the need for more prospective clinical trials. Some side effects were described in an open-label study,<sup>5</sup> such as morning headaches, somnolence and psychosis (hallucinations and delusions).

Our group has recently assessed the effects of CBD in the treatment of patients with PD and psychosis and found a significant improvement in psychotic symptoms. Also, there was a significant improvement as measured with a global scale to assess PD (Unified Parkinson's Disease Rating Scale, UPDRS) and reports of clinical improvement in sleep.<sup>6</sup> Next, we started a parallel double-blind, placebo-controlled exploratory trial to assess the effects of CBD (at doses of 75 and 300 mg) on PD symptoms. This case series aimed to describe the clinical outcome relative to the patients with PD who had a previous diagnosis of RBD after breaking the blind. No patients had current or previous psychiatric disorder or were taking antidepressants.

We included in this case series all patients ( $n = 4$ ) who fulfilled the following inclusion criteria: (i) complete clinical assessment for RBD by a neurologist specialized in sleep disorders and (ii) at least two episodes of complex sleep-related behaviours per week.

From these, two had symptoms and polysomnography (PSG) results compatible with RBD and were classified as patients with definite RBD, and two had RBD-compatible symptoms not confirmed by PSG and were classified as patients with probable RBD. None of the patients had been previously treated for RBD. Three patients received CBD 75 mg/day, and one received CBD 300 mg/day for 6 weeks. Unfortunately, no patients who took placebo had the same characteristics of our cases.

The study was approved by the local ethics committee, and all patients provided their signed consent to participate (HCRP no. 8990/2011).

## DETAILS OF THE CASES

### Case 1

A 61-year-old man diagnosed with PD for 18 years and with episodes of agitation and behavioural alterations during sleep

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characterized by talking, swearing, yelling, pushing, kicking and punching, and gesturing. These features preceded the onset of PD by 2 years and had already resulted in injury to the patient's wife. Although the patient recognized the occurrence of these episodes at a frequency of one per month, the wife reported that they took place between two and four times every week, lasting for around 2 min and occurring mainly in the middle third of sleep. Dream content with these problematic behaviours consisted mostly of being at work, being attacked by animals and being in a fight. RBD was confirmed by PSG showing REM sleep without atonia. Clinical assessments were made at baseline and in the last week of treatment with CBD 75 mg/day. During the 6 weeks of treatment, the patient had no episodes of agitation, aggressive behaviour or nightmare during sleep according to his own and his wife's account.

#### Case 2

A 59-year-old man was diagnosed with PD at age 53 years and RBD with onset of episodes 1 year before. According to wife, the episodes were brief, lasting for seconds, and consisted of talking, yelling, laughing, gesturing, pushing and mainly kicking the bedside table. Episodes occurred between two and four times a week, mainly in the final third of sleep. The patient reported that he seldom remembered his dreams, but that when he did, contents were usually related to arguments with relatives and animal attacks. Unfortunately, the patient did not enter REM sleep during PSG, which hampered diagnostic confirmation. CBD was introduced at 75 mg/day, and no episodes of agitation, kicking or nightmare were reported during the 6 weeks of treatment.

#### Case 3

A 63-year-old man was diagnosed with PD 4 years earlier and also had daily episodes of talking, yelling, singing, pushing, punching and kicking during sleep. The patient reported dreams in which he was playing soccer and associated dream contents with the kicking behaviour. Also according to the patient, the symptoms began before the onset of PD and frequently led to his awakening, in addition to having caused injury to his wife. The patient's diagnosis was probable RBD as he did not wish to undergo PSG. CBD 75 mg/day was introduced, and no episodes or complaints of aggressive behaviour or nightmare were reported during the 6-week treatment period.

#### Case 4

A 71-year-old man was diagnosed with PD 3 years before and had between two and four episodes of complex movements during the night per week. The most common behaviours in these episodes included laughing, kicking, pushing and punching. The patient reported that he seldom remembered his dreams, but described dreams with fun content and others in which he was assaulted by people. Also according to the patient, the symptoms started long before the onset of PD, when he was 40 years old. PSG confirmed the clinical suspicion of RBD by the presence of atonia loss during REM sleep. For 6 weeks, the patient used CBD 300 mg/day with behaviour and dream improvement, describing a reduction in the frequency of episodes to one episode per week during the treatment (Table 1).

#### WHAT IS NEW AND CONCLUSION

We have described the beneficial effects of treatment with CBD in the reduction of symptoms highly suggestive of RBD in PD. In this case series, the four patients treated with CBD had prompt, substantial and persistent reduction in the frequency of RBD-related events. Regarding symptoms after drug discontinuation, RBD complex movements returned with the same frequency and intensity of baseline after the treatment was interrupted. All patients were referred to the local specialized sleep outpatient clinic. The mechanism of therapeutic action at present can only be speculated upon.

Concerning the effects of CBD on sleep, animal studies have found different results according to the dose and route of administration used.<sup>7-9</sup> The intracerebroventricular administration of CBD led to an increase in wakefulness and consequent reduction in REM sleep in rats.<sup>9</sup> A complementary study found reductions in slow-wave and REM sleep, accompanied by increased wakefulness after CBD infusion into the lateral hypothalamus and dorsal raphe nucleus.<sup>10</sup>

CB<sub>1</sub> receptors are found in many brain areas, including those directly related to the regulation of the sleep-wake cycle.<sup>11</sup> In animal models, the activation of CB<sub>1</sub> receptors by anandamide, an endogenous cannabinoid, increased the duration of slow-wave and REM sleep and reduced wakefulness.<sup>12</sup> Conversely, the inverse agonist of the CB<sub>1</sub> receptor SR141716A increased wakefulness in association with reductions in slow-wave and REM sleep.<sup>13</sup>

Few studies have explored the effects of CBD on sleep in humans and none investigated the effects of CBD on sleep in PD. In patients with RBD, the depletion of mesencephalic cholinergic

**Table 1.** Description of patients with PD and symptoms compatible with RBD

Patient	Symptoms	Polysomnography	Cannabidiol dose	Frequency of symptoms before treatment	Frequency of symptoms after treatment
1	Swearing, talking, yelling, pushing, kicking, punching and gesturing	Compatible PLMI = 0	75 mg	2-4× week	0
2	Yelling, talking, laughing, gesturing, pushing and kicking	Patient did not enter REM sleep during examination PLMI = 0	75 mg	2-4× week	0
3	Talking, yelling, singing, pushing, punching and kicking	Patient refused to undergo examination	75 mg	7× week	0
4	Laughing, kicking, pushing and punching	Compatible PLMI = 84.9	300 mg	2-4× week	1× week

PLMI (events/h), Periodic Leg Movement Index; RBD, REM sleep behaviour disorder; PD, Parkinson's disease.

neurons could be at least partially accountable for the genesis of the disorder.<sup>14</sup> This hypothesis could explain, in part at least, the therapeutic action of cholinesterase inhibitors<sup>15</sup> and could justify CBD's property of improving RBD-compatible symptoms. CB<sub>1</sub> receptors are distributed in areas related to sleep, including the basal prosencephalon and the pedunculo-pontine and laterodorsal nuclei<sup>16</sup>, and are expressed in cholinergic neurons. The activation of these receptors by CBD could favour the release of acetylcholine<sup>17</sup> and hence cause symptom improvement through a mechanism similar to the one proposed for anticholinesterase agents.

It is interesting to note that RBD is regarded as a prodromal symptom of PD that may precede the onset of motor symptoms by many decades.<sup>18</sup> CBD has been investigated as a possible neuroprotective agent in animal models of PD<sup>19–21</sup>, and this case series suggests that CBD can have therapeutic effects in the treatment of RBD in PD. Then, this hypothesis underscores the need for studies with larger therapeutic windows exploring the endocannabinoid system in regard to its neuroprotective potential, especially when we know that CBD is a safe, well-tolerated drug.<sup>22</sup>

Before concluding, it is important to mention that this study is based on a small case series of patients with RBD and examines secondary outcomes, which hampers a more detailed clinical

examination of the cases. Other limitations include the fact that only two patients had confirmation of REM sleep without atonia through PSG and no further PSG was repeated in the course of the use of CBD or afterwards for comparison. Finally, the short follow-up period can be considered a major limitation of our study because of the variation in the clinical manifestations of RBD over time.

Despite its intrinsic limitations, this case series indicates that CBD is able to control the symptoms of RBD. Further research is necessary to confirm the possibly beneficial effects of CBD in the treatment of RBD in patients with PD.<sup>23</sup> Furthermore, the enrolment of patients with idiopathic RBD in clinical trials with CBD is desirable as it would enable the investigation of the effects of the drug both on the symptoms of the disorder and as a neuroprotective agent.

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