Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity (2019) 24:383–384
https://doi.org/10.1007/s40519-019-00684-x

EDITORIAL

Parkinson's disease, dopamine, and eating and weight disorders: an illness in the disease?

Nazario Melchionda[1] · **Massimo Cuzzolaro**[2]

Received: 10 February 2019 / Accepted: 26 March 2019 / Published online: 4 April 2019

In patients with Parkinson's disease (PD), a well-balanced diet improves general health and motor strength. Furthermore, a beneficial régime (for example, a Mediterranean diet) is recommended in early- to mid-stage of the disease for maintaining cognitive health [1].

Despite this, an interesting article by Ingrid de Chazeron et al. [2] reminds that eating and weight disorders are frequent in PD patients and draws attention to this crucial but hardly studied issue.

Persons suffering from PD and treated with dopaminergic agents usually do not ask for treatment of their unhealthy eating habits, and neurologists often underestimate the problem. Obesity is the result in many cases, and a multidimensional team approach would be desirable.

A brief historical note may introduce the topical subject.

James Parkinson wrote the first clear-cut description of the *shaking palsy* in 1817, as a neurological syndrome with "involuntary tremulous motion […] lessened muscular power […] a propensity to bend the trunk forward, and to pass from a walking to a running pace" [3].

From the last decades of the nineteenth century to the mid-twentieth century, the treatment of PD was based on centrally active anticholinergic agents, beginning from belladonna alkaloids.

The degeneration of dopaminergic neurons of the nigrostriatal pathway and the subsequent brain dopamine deficit in patients with PD were discovered only in 1960 and, from 1961 onwards, L-DOPA (levodopa or L-3,4-dihydroxyphenylalanine, $C_9H_{11}NO_4$) became the primary drug to treat Parkinson's motor symptoms. L-DOPA can cross the blood–brain barrier and be converted into dopamine ($C_8H_{11}NO_2$) by the enzyme DOPA decarboxylase [4].

In addition to motor symptoms, people suffering from PD present also a broad spectrum of non-motor symptoms (NMS) such as hyposmia, constipation, sleep–wake cycle disturbances, mood disorders, cognitive dysfunctions, hallucinations, delusions, personality changes, and multifaceted behavioral disorders, particularly impulse control disorders.

In some cases, NMS precede the occurrence of the motor phenomena, but in a majority of patients they appear with advancing disease and treatment. NMS significantly contribute to disability and disease burden for patients and caregivers [5].

It remains unclear which PD non-motor symptoms are dependent on the dopaminergic deficit, are related to non-dopaminergic systems, or are due to the dopaminergic therapy [6, 7].

In recent years, an increasing number of studies focused on impulse control disorders (ICD) in persons with PD such as compulsive buying, obsessive hobbying, pathological gambling, medication abuse, sex addiction, and compulsive overeating [8].

Treatment with dopaminergic agents improves PD motor symptoms but probably weakens the ability to control the compulsive repetition of rewarding behaviors.

Both L-DOPA and dopamine agonists (for example, bromocriptine, pramipexole, rotigotine, ropinirole) are associated with the onset of impulse control problems. However, an extensive survey of 3090 PD patients found that four ICD (compulsive buying, pathological gambling, sex addiction, binge eating disorder) were more common in patients treated with a dopamine agonist: 17.1% vs. 6.9% [9].

Some findings suggested that chronic dopaminergic treatment—in particular with dopamine agonists—induces a down-regulation of striatal dopamine receptor type-2 (D_2R) [10]. A recent systematic review also underlined the role of a predisposition [11]. Another systematic review confirmed that dopamine agonists could contribute to the development

This article is part of Topical collection on Food and Addiction.

✉ Massimo Cuzzolaro
massimo.cuzzolaro@gmail.com

[1] Formerly Alma Mater University, Bologna, Italy

[2] Formerly Sapienza University, Roma, Italy

of ICDs that should be considered as multifactorial symptoms "involving drug-, patient-, and disease-related factors" [12] (p. 19).

The study of ICD in PD patients offers a heuristic opportunity to explore the role of different dopaminergic projections and dopamine receptors in impulse control difficulties and, in particular, in binge eating, food craving, and food addiction that are still controversial concepts with uncertain implications for etiology and treatment [13–15].

Many clinical questions arise. Is binge eating disorder (BED) different in PD? Could BED-oriented cognitive-behavioral therapy be useful also in BED with PD? How could we prevent disordered eating behaviors and weight gain in PD?

Funding No funding was received for this work.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent For this type of article (Editorial) informed consent is not required because it does not contain any studies with human participants performed by any of the authors.

References

1. Goldman JG, Vernaleo BA, Camicioli R, Dahodwala N, Dobkin RD, Ellis T, Galvin JE, Marras C, Edwards J, Fields J, Golden R, Karlawish J, Levin B, Shulman L, Smith G, Tangney C, Thomas CA, Troster AI, Uc EY, Coyan N, Ellman C, Ellman M, Hoffman C, Hoffman S, Simmonds D (2018) Cognitive impairment in Parkinson's disease: a report from a multidisciplinary symposium on unmet needs and future directions to maintain cognitive health. NPJ Parkinsons Dis 4:19. https://doi.org/10.1038/s41531-018-0055-3
2. de Chazeron I, Durif F, Chereau-Boudet I, Fantini ML, Marques A, Derost P, Debilly B, Brousse G, Boirie Y, Llorca PM (2019) Compulsive eating behaviors in Parkinson's disease. Eat Weight Disord. https://doi.org/10.1007/s40519-019-00648-1
3. Parkinson J (1817) An essay on the shaking palsy. Whittingham and Rowland for Sherwood, Needly and Jones, London
4. Hornykiewicz O (2002) L-DOPA: from a biologically inactive amino acid to a successful therapeutic agent. Amino Acids 23(1–3):65–70. https://doi.org/10.1007/s00726-001-0111-9
5. Marinus J, Zhu K, Marras C, Aarsland D, van Hilten JJ (2018) Risk factors for non-motor symptoms in Parkinson's disease. Lancet Neurol 17(6):559–568. https://doi.org/10.1016/S1474-4422(18)30127-3
6. Park SB, Kwon KY, Lee JY, Im K, Sunwoo JS, Lee KB, Roh H, Ahn MY, Park S, Kim SJ, Oh JS, Kim JS (2019) Lack of association between dopamine transporter loss and non-motor symptoms in patients with Parkinson's disease: a detailed PET analysis of 12 striatal subregions. Neurol Sci 40(2):311–317. https://doi.org/10.1007/s10072-018-3632-7
7. Rosqvist K, Odin P, Hagell P, Iwarsson S, Nilsson MH, Storch A (2018) Dopaminergic effect on non-motor symptoms in late stage Parkinson's disease. J Parkinsons Dis 8(3):409–420. https://doi.org/10.3233/JPD-181380
8. Weintraub D, Mamikonyan E (2019) Impulse control disorders in Parkinson's disease. Am J Psychiatry 176(1):5–11. https://doi.org/10.1176/appi.ajp.2018.18040465
9. Weintraub D, Koester J, Potenza MN, Siderowf AD, Stacy M, Voon V, Whetteckey J, Wunderlich GR, Lang AE (2010) Impulse control disorders in Parkinson disease: a cross-sectional study of 3090 patients. Arch Neurol 67(5):589–595. https://doi.org/10.1001/archneurol.2010.65
10. Politis M, Wilson H, Wu K, Brooks DJ, Piccini P (2017) Chronic exposure to dopamine agonists affects the integrity of striatal D(2) receptors in Parkinson's patients. NeuroImage Clin 16:455–460. https://doi.org/10.1016/j.nicl.2017.08.013
11. Latella D, Maggio MG, Maresca G, Saporoso AF, Le Cause M, Manuli A, Milardi D, Bramanti P, De Luca R, Calabro RS (2019) Impulse control disorders in Parkinson's disease: a systematic review on risk factors and pathophysiology. J Neurol Sci 398:101–106. https://doi.org/10.1016/j.jns.2019.01.034
12. Grall-Bronnec M, Victorri-Vigneau C, Donnio Y, Leboucher J, Rousselet M, Thiabaud E, Zreika N, Derkinderen P, Challet-Bouju G (2018) Dopamine agonists and impulse control disorders: a complex association. Drug Saf 41(1):19–75. https://doi.org/10.1007/s40264-017-0590-6
13. Brewerton TD (2017) Food addiction as a proxy for eating disorder and obesity severity, trauma history, PTSD symptoms, and comorbidity. Eat Weight Disord 22(2):241–247. https://doi.org/10.1007/s40519-016-0355-8
14. Vella SC, Pai NB (2017) A narrative review of potential treatment strategies for food addiction. Eat Weight Disord 22(3):387–393. https://doi.org/10.1007/s40519-017-0400-2
15. Meule A (2019) A Critical examination of the practical implications derived from the food addiction concept. Curr Obes Rep. https://doi.org/10.1007/s13679-019-0326-2