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ORIGINAL ARTICLE

Impulse control disorders and *punding* in Parkinson's disease: the need for a structured interview ☆

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Abstract
Introduction: Impulse control disorders (ICD), including hypersexuality, compulsive gambling, buying, eating, shopping and dopaminergic medication use, have been reported to occur frequently in Parkinson's disease (PD). *Punding* (complex, repetitive, excessive, non-goal oriented behaviours) has also been described. As patients may not report such behaviours to their neurologist. ICD and *punding* appear to be under-recognised in clinical practice.
Method: We prospectively screened 216 consecutive patients (102 men, age 77±5 years) with idiopathic PD. Patients and their caregivers were encouraged to complete a questionnaire with six questions on symptoms related to ICD and *punding*. In addition, we obtained a random sample matched by age and sex of 216 patients with idiopathic PD, and retrospective analysis of symptoms related to ICD and *punding* who had been referred spontaneously.
Results: Only 20 cases (9.26%) of 216 patients with PD who answered the questionnaire prospectively presented ICD and / or *punding*, some involving more than one type of repetitive behaviour and reward-seeking: 7 hypersexuality (3.24%), 2 pathological gambling (0.93%), 4 compulsive buying (1.85%), 2 compulsive eating (0.93%), 8 *punding* (3.70%) and 1 abuse of medication (0.46%). Of the retrospective sample of 216 age- and gender-matched patients, only 5 (2.31%) had spontaneously mentioned these symptoms: 2 hypersexuality (0.93%), 2 pathological gambling (0.93%) and 1 *punding* (0.46%).
Conclusions: Patients with PD do not spontaneously admit the presence of ICD or *punding* and these behaviours appear to be under-recognised in clinical practice. A screening questionnaire is needed to ensure their detection.

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PALABRAS CLAVE
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Comportamiento estereotipado

Trastornos del control de los impulsos y *punding* en la enfermedad de Parkinson: la necesidad de una entrevista estructurada

Resumen
Introducción: Los trastornos del control de impulsos (TCI) que incluyen hipersexualidad, ludopatía, compulsión por comer, comprar y consumir fármacos dopaminérgicos, han sido descritos en la enfermedad de Parkinson (EP) así como el *punding* (comportamiento estereotipado que comprende rituales motores automáticos, sin finalidad). Dado que los pacientes no suelen referir a su neurólogo estas conductas, el TCI y el *punding* están infradiagnosticados en la práctica clínica.
Método: Prospectivamente a 216 pacientes consecutivos (102 hombres, edad media 77 ± 5 años) con EP idiopática se les preguntó sistemáticamente sobre síntomas relacionados con TCI y *punding*. Además, se obtuvo una muestra al azar apareada por edad y sexo, de 216 pacientes con EP idiopática, y se revisó retrospectivamente la presencia de síntomas relacionados con TCI y *punding* que habían sido referidos espontáneamente.
Resultados: Veinte casos (9,26%) de 216 pacientes con EP que contestaron el cuestionario de forma prospectiva presentaron TCI y/o *punding*, algunos de ellos con más de un tipo de conducta repetitiva: 7 hipersexualidad (3,24%), 2 ludopatía (0,93%), 4 compra compulsiva (1,85%), 2 atracones (0,93%), 8 *punding* (3,70%) y uno abuso de medicación (0,46%). De la muestra retrospectiva de 216 pacientes apareados por edad y sexo, sólo 5 pacientes (2,31%) habían referido de forma espontánea estos síntomas: 2 hipersexualidad (0,93%), 2 juego patológico (0,93%) y uno *punding* (0,46%).
Conclusiones: Los pacientes con EP no admiten espontáneamente la presencia de TCI y *punding*, por lo que estas conductas están infradiagnosticadas. Para garantizar su detección es necesaria la realización de una entrevista dirigida.

Introduction

Non-motor symptoms in Parkinson's disease (PD) have been receiving more and more attention over the course of the last decade, with psychopathological disorders being of particular interest given the frequency with which they are present and their seriousness. In this group of symptoms, repetitive and reward-seeking behaviours[1] have been reported that include impulse control disorder (ICD) and stereotyped behaviour (*punding*).[1-8]

DSM-IV[9] defines ICD as the inability to resist an impulse, attraction or temptation to perform an act that results in harm to self or to one's surroundings. It includes alterations in sexual behaviour, ludopathy or pathological gambling, compulsive shopping, bulimic episodes and compulsive use of medication. The predisposing factors for the development of ICD in PD are being male, duration of the evolution of the disease, early onset of disease, predominantly rigid-akinetic forms of PD, high doses of levodopa, treatment with dopaminergic agonists, personal or family history of substance abuse or affective disorders, and impulsive personality.[1-10]

Stereotypical behaviour or *punding* consists of automatic, purposeless, motor rituals that are not associated with compulsion; they are generally related to previous hobbies and are accompanied by a subjective feeling of fascination and pleasure: cleaning activities, assembling and disassembling objects, gardening tasks, writing, drawing or crafts, etc. The predisposing factors in PD are high doses of levodopa, as well as dopaminergic agonists in monotherapy or in combination-[1,2,5,7,10-13]

Most authors agree that the prevalence of ICD in PD is higher than what is seen in the general population, which is from 0.3-1.3%. However, this prevalence in PD varies greatly among the different series published in the literature[1-8,10-19] depending on whether the studies are prospective or retrospective, if the patient is asked directly about the symptoms or not, if all PD patients are included or only those who are being treated with dopaminergic agonists, and according to the symptoms being assessed in each series (hypersexuality, gambling, compulsion for shopping, food or medication, and *punding*).

One of the issues we face as regards ICD and *punding* in PD is the difficulty that often arises in establishing the diagnosis. Not all patients are aware of their problem, and will sometimes respond aggressively to the people around them who try to convince them that they need medical care. For these reasons, symptoms related to ICD and *punding* are generally not spontaneously reported to the neurologist at regular check-ups for PD.

We carried out a prospective study in which all consecutive PD patients who went to the Neurology Department were asked directly about the presence of symptoms relating to ICD and *punding*, with the aim of detecting all the existing cases and compare them to a retrospective sample in which the patients had spontaneously reported these symptoms.

Table 1 Structured questionnaire on symptoms associated with impulse control disorder and stereotypical behaviour *(punding)*

Have you observed any change in your sexual behaviour since the onset of Parkinson's disease?	☐ Yes ☐ No
Have you noticed an interest and/or excessive spending on slot machines, lotteries, sports pools, and/or bingos?	☐ Yes ☐ No
Do you make excessive and unnecessary purchases (clothing, food, worthless objects)?	☐ Yes ☐ No
Do you perform any kind of repetitive behaviour or activities such as assembling and taking apart radios, cell phones, video players, or other types of oddities or quirks?	☐ Yes ☐ No
Do you think that you sometimes eat too much or do you binge?	☐ Yes ☐ No
Do you insist on and/or abuse your medication?	☐ Yes ☐ No

Patients and methods

Over the course of 7 months, 216 consecutive patients (102 males and 114 females) were included with a mean age of 77±5.00 years (56-93 years) diagnosed with PD according to the criteria of the British Brain Bank[20] and who attended the Neurology Outpatient Clinic at the Hospital General de l'Hospitalet. Those PD patients who had previously been diagnosed with ICD and/or *punding* were excluded. During the visit, they were given a 6-item questionnaire (table 1) designed by a psychiatrist (XC) about symptoms related with ICD and *punding*. The questionnaire was self-rated and could be answered by the patients themselves and/or the person accompanying them with yes/no answers. In those cases with an affirmative answer, they were questioned in greater depth about the symptoms reported to see if they met DSM-IV[9] criteria for ICD or *punding*.

Later, using a database of patients diagnosed with PD according to the criteria of the British Brain Bank[20] who usually visited the neurology outpatient clinic, a sample comparable to the previous one was obtained and consisted of 216 patients matched for age and gender: 97 males and 119 females with a mean age of 77.14±4.99 years (56-93 years). A retrospective review was conducted in search of the existence of ICD and/or *punding* symptoms spontaneously reported by the patients or by the people accompanying them during their routine visits.

Gender, age, years of evolution of PD, the Hoehn-Yahr scale,[21] types and doses of anti-Parkinson's treatment were recorded for both groups of patients. We calculated the daily levodopa equivalent dose (DLED) for all the doses of levodopa in its various formulations (levodopa-carbidopa, levodopa-benserazide, slow-release levodopa, levodopa+entacapone) and the total daily levodopa equivalent dose (TDLED) for all the doses of levodopa and dopaminergic agonists. To do so, we used the formulae described in other articles having similar characteristics:[3,11,12] 100 mg of levodopa=130 mg of slow-release levodopa=70 mg of levodopa+entacapone=1 mg of pramipexole=5 mg of rotigotine=5 mg of ropirinol. Other anti-Parkinson's medications (amantadine, selegiline or rasagiline) were not included in the analysis.

The data analysis was performed using the SPSS statistical software programme for Windows. After an initial descriptive study, the different variables of interest were compared between both groups of study by means of the followings tests:

1. Student's "t" test for independent data or Mann-Whitney U test, in the event that the assumption of normality was not met, to compare quantitative variables.
2. Chi-square test to analyze qualitative variables.

P values of 0.05 or less were deemed statistically significant.

Results

The descriptive analysis of the variables gender, age, years of evolution of PD, Hoehn-Yahr scale,[20] DLED, and TDLED for both samples of patients with PD is reflected in table 2. We find significant differences in the years of evolution elapsed since the onset of PD between the group of prospectively collected patients and the retrospective sample matched for age and gender. There are no significant differences between groups in any of the other variables.

Of the total of 216 PD patients who answered the questionnaire prospectively, ICD and/or *punding* was detected in 20 cases (9.26%); some of them had more than one type of repetitive and reward-seeking behaviour associated: 7 cases of hypersexuality (3.24%), 2 cases of gambling (0.93%), 4 cases of compulsive shopping (1.85%), 2 cases of compulsion for food (0.93%), 8 cases of *punding* (3.70), and one case of medication abuse (0.46%). The characteristics of gender, age, age at onset of PD, Hoehn-Yahr's scale, types of medication, and doses are presented in table 3.

Of the retrospective sample of 216 patients matched for age and gender, only 5 patients (2.31%) had spontaneously reported symptoms related with repetitive and reward-seeking behaviours: 2 patients with hypersexuality (0.93%), 2 patients with gambling (0.93%), and one patient with

Table 2 Clinical characteristics of Parkinson's patients in the prospective and retrospective groups

Clinical characteristics	Prospective group (n=216)	Retrospective group (n=216)	p
Age in years, Mean±SD (minimum-maximum)	77±5 years (56-93)	77.14±4.99 years (56-93)	0.77 (NS)
Gender, Percentage of males (n)	47.22% (n=102)	44.91% (n=97)	0.63 (NS)
Years of evolution of PD			
Mean±SD (minimum-maximum)	6.09±4.30 (0.10–20.99)	7.37±5.30 (0.19-30.87)	7
Median	4.63	6.06	
Hoehn-Yahr's scale, Median (minimum-maximum)	2.00 (1-5)	2.00 (1-5)	0.85 (NS)
DLED mg/day, Mean±SD (minimum-maximum)	514.06±249.52 (142–1373.63)	527.57± 252.22 (100-1471.43)	0.63 (NS)
TDLED mg/day, Mean±SD (minimum-maximum)	575.97±312.61 (75-1542.86)	549.52±333.98 (60-1921.43)	0.43 (NS)

DLED: daily levodopa equivalent dose for all the doses of levodopa in all its presentations (levodopa-carbidopa, levodopa-benserazide, slow-release levodopa, levodopa+entacapone); TDLED: total daily levodopa equivalent dose for all the doses of levodopa and dopaminergic agonists; SD: standard deviation; n: number of patients; NS: not significant.

punding (0.46%). The characteristics of gender, age, age at onset of PD, Hoehn-Yahr's scale, types of medication, and doses are recorded in table 4.

Discussion

The reported prevalence of ICD associated to PD is 6-9% and can be as much as 13% if only PD patients treated with dopaminergic agonists are included.[1-19] It is difficult to ascertain the true prevalence of these disorders because they are under-diagnosed. In many cases, the patients do not report these types of behaviours because they do not consider them to be abnormal, unpleasant, or because they do not relate them to their PD. However, early recognition is important, given that these repetitive behaviours tend to interfere with normal eating, hygiene, sleep, and medication schedules.

We carried out a prospective study of 216 patients with PD who were asked directly about symptoms related with ICD (hypersexuality, gambling, compulsive shopping, hyperphagia, and medication abuse) and *punding* and compared it with a retrospective sample matched for age and gender. Retrospectively, only five patients (2.31%) had reported ICD symptoms, whereas when the patient and/or person accompanying them were asked directly at the visit, 20 patients affected (9.26%) were identified.

The presence of ICD has been related to being male, years of evolution of disease, early onset of disease, high doses of levodopa, and the use of dopaminergic agonists.[1-8, 10] On comparing both groups, we have found a significant difference in the years of evolution of PD between the prospective sample and the retrospective sample matched for age and gender, given that the retrospective sample has a longer interval since being diagnosed with PD. Nevertheless, this datum does not change the conclusions of the study, since the presence of ICD is known to be related with a longer time of evolution of PD. We have not found significant differences between both groups in any of the other variables examined (Hoehn-Yahr's scale, DLED, and TDLED), meaning that both samples are comparable. The use of dopaminergic agonists, as a class effect and, hence, unrelated to the type or dose, has been associated with the presence of ICD and/or *punding.*[1,3-5,8,10,12] However, of the 25 patients from both groups in whom some type of ICD is identified, 6 cases (24%) were being treated with levodopa in monotherapy or associated with rasagiline or selegiline, and consequently, without any dopaminergic agonist.

If each ICD is analyzed separately, with respect to alterations in sexual behaviour we find hypersexuality, defined as the appearance of greater demands on the person's partner for sexual activity, frequenting sex venues, searching for and visiting pornographic websites on Internet, buying pornographic magazines, etc. The prevalence of hypersexuality varies widely.[1,4,5,7,8,14] In a recent prospective study, the authors cite a prevalence rate of 2.4% in patients with PD that can go as high as 7.2% in patients treated with dopaminergic agonists.[1] In our series, we have found a prevalence of 0.93% in the retrospective series, which increases to 3.24% in the prospective series. All the cases are males, who do not recognize their hypersexuality as being pathological, who display a large increase in the sexual activity they demand of their partner, despite the fact that it is sometimes associated with impotence. In many cases, the families do not report it to the physician out of modesty and the targeted questions facilitate the manifestation of these symptoms.

Insofar as ludopathy or pathological gambling is concerned, it appears in 0.5-7% of cases, depending on the series.[1,4,5,7,8,15-18] In our setting, it is more closely related to slot machines, whereas in other countries, card games and visiting casinos are more common.[6,15] Although it was initially thought to be related to the use of pramipexole, we now know that it is related to treatment with any type of dopaminergic agonist as a class effect, and that it is not associated with the dose administered or with the type of agonist. It is generally serious, with great impact on social and family relations, and this is, perhaps, the reason why it

Table 3 Characteristics of patients with Parkinson's disease and impulse control disorder and/or punding prospectively detected

Ptt	Sex	Age at PD onset	Age at ICD diagnosis (years)	H-Y	Treatment	Dose (mg/day)	ICD/*punding*
1	M	61	63	2	Levodopa	300	Binging
					Pramipexole	2.5	
2	M	64	80	3	Rasagiline	1	*Punding* (fixing walker, reading papers)
					Levodopa-entacapone	600	
					Rotigotine	16	
3	M	60	81	2	Rasagiline	1	*Punding* (reading package inserts)
					Levodopa	700	
							Binging
							Drug abuse
4	M	65	76	5	Levodopa-entacapone	600	*Punding* (checking bills and receipts)
					Pramipexole	4	
							Hypersexuality
5	F	73	78	1.5	Slow-Release Levodopa	600	*Punding* (tidying drawers)
6	F	74	77	2	Levodopa	800	Compulsive Shopping
					Rasagiline	1	
7	M	72	75	1	Pramipexole	1.5	Gambling
8	F	74	83		Levodopa	600	Compulsive Shopping
					Pramipexole	4	
9	F	76	79	1.5	Levodopa	800	*Punding* (sewing and washing clothes)
					Pramipexole	4	
10	M	82	85	1	Levodopa	600	Hypersexuality
11	M	75	78	2	Levodopa	750	Hypersexuality
					Pramipexole	3.5	
12	F	61	73	2	Levodopa-entacapone	300	*Punding* (crafts)
					Pramipexole	3.5	
13	M	71	75	2	Levodopa	400	*Punding* (building cages)
					Pramipexole	4.5	
14	M	59	62	1	Delayed-release ropirinol	24	Hypersexuality
15	M	59	73	2	Levodopa-entacapone	600	Hypersexuality
					Pramipexole	3	
16	M	69	76	2	Levodopa-entacapone	600	*Punding* (putting together and taking apart clocks)
					Pramipexole	3	
							Compulsive Shopping
17	M	76	80	3	Levodopa-entacapone	150	*Punding* (tidies papers)
					Pramipexole	0.50	Hypersexuality
18	F	73	77	2	Levodopa-entacapone	200	Compulsive Shopping
					Rasagiline	1	
19	M	69	70	1	Slow-Release Levodopa	300	Gambling
20	M	61	75	3	Levodopa-entacapone	600	*Punding* (assembling and disassembling radios, computers)
					Levodopa	375	Hypersexuality
					Ropirinol	20	

PD: Parkinson's disease; H-Y: Hoehn-Yahr's scale; mg: milligrams; ICD: impulse control disorder.

is spontaneously reported by the people accompanying PD patients. In our retrospective series, as well as in our prospective series, we find a prevalence rate of 0.93%, below prevalence rates reported in the literature.[15-18]

Compulsive shopping is characterized by spending exorbitant amounts of money on objects whose usefulness is dubious. Its prevalence has been estimated at 0.4-2%,[1,4,8] which coincides with our prospective series (1.85%), without a single case having been found in the retrospective sample. It is more common in women and the main consequence is the accumulation of useless or unnecessary objects.

Compulsion for food is characterized by excessive and uncontrollable eating and tends to be accompanied by binge eating. The true prevalence of this disorder is unknown, although it has been reported in up to 4.3% of the cases and

Table 4 Characteristics of patients with Parkinson's disease and impulse control disorder and/or punding retrospectively detected

Ptt	Sex	Age at PD onset	Age at ICD diagnosis (years)	H-Y	Treatment	Dose (mg/day)	ICD/*punding*
1	M	44	59	2	Levodopa Levodopa-entacapone Pergolide	900 600 3	Gambling
2	M	69	73	2.5	Levodopa Selegiline	600 10	Hypersexuality
3	M	58	64	3	Levodopa-entacapone Pergolide	800 3	*Punding* (genitalia)
4	M	63	67	1	Levodopa Pramipexole	300 1.5	Hypersexuality
5	M	63	70	1	Levodopa Ropirinol	450 6	Gambling

PD: Parkinson's disease; H-Y: Hoehn-Yahr's scale; mg: milligrams; ICD: impulse control disorder.

is more common in females.[4,8,19] We have not identified a single case in our retrospective series and, when directly questioned, we found 2 cases out of the 216 patients with PD (0.93%).

We have detected just one patient exhibiting an abuse of medication that we have interpreted as symptomatic of ICD, since the same patient also displayed compulsive eating and *punding*. In the literature, a distinction is sometimes made between abuse of medication and levodopa imbalance syndrome, defined as the compulsive, excessive consumption of levodopa, in amounts greater than what are needed to achieve good motor control in PD.

Stereotypy or *punding* consists of performing motor activities that are generally fairly useless, unrelated to compulsion, and that provide the patient with a great non-productive, exaggerated and often inappropriate fascination. These activities vary and include handling, storing, ordering, classifying, or repeatedly, stereotypically, and purposelessly assembling and disassembling objects.[1,2,5,7,10-13] It is unassociated with psychotic or affective symptoms, and it is not related to obsessive thoughts or cognitive impairment. The prevalence of *punding* is also arguable and varies depending on the series.[1,11-13] One prospective study[11] detected *punding* in 14% of PD patients (17 out of 123 patients), although it goes up to 34% (17 out of 50 subjects) if only those patients with PD under treatment with levodopa-equivalent doses greater than 800 mg/day are considered. In our retrospective series, only one patient with PD had reported having this type of stereotypy. However, when questioning patients directly, we found 8 cases of *punding* (3.70%) performing all sorts of activities: assembling cages with material collected from garbage containers; fixing radios, computers or clocks; assembling and disassembling their walker; sewing bits of fabric; sorting bills, papers, drawers, etc. These activities were performed by the patients during the greater part of the day and even interfered with everyday activities. Nonetheless, neither the patients nor their relatives had reported it at any of their prior visits, probably because they did not believe that it might be related to PD; because they interpreted it as the patient's hyperactivity, or because they did not consider it pathological.

We are not seeking to validate any new questionnaire that would no do anything more than complicate the already complex visit with PD patients. In fact, a questionnaire has recently been published that has been validated for the study of ICD in PD[22] with two versions: a short form and another longer one that has proven a high degree of specificity and sensitivity in the detection of ICD in these patients. We have not used it in our study, because we had already begun our study before the questionnaire was published. The true aim of this study, as corroborated by the results obtained, is to demonstrate that ICD and *punding* are under-diagnosed in the Parkinson patient population due to the lack of spontaneous reporting by patients and relatives. This lack of recognition of ICD and *punding* in PD should be overcome by a meticulous history and guided questioning before initiating and/or modifying dopaminergic treatment.

Conflict of interest

The authors state that there are no conflict of interest.

References

1. Voon V, Hassan K, Zurowski M, de Souza M. Thomsen T, Fox S, et al. Prevalence of repetitive and reward-seeking behaviors in Parkinson's disease. Neurology. 2006;67:1254-7.
2. Pontone G, Williams JR, Basset SS, Marsh L. Clinical features associated with impulse control disorders in Parkinson's disease. Neurology. 2006;67:1258-61.
3. Mamikonyan E, Siderowf AD, Duda JE, Potenza MN, Horn S, Stern MB, et al. Long-term follow-up of impulse control disorders in Parkinson's disease. Mov Disord. 2008;23:75-80.
4. Merims D, Giladi N. Dopamine dysregulation syndrome, addiction and behavioral changes in Parkinson's disease. Parkinsonism Relat Disord. 2008;14:273-80.
5. Weintraub D. Dopamine and impulse control disorders in Parkinson's disease. Ann Neurol. 2008;64 Suppl:S93-S100.

6. López-Moríñigo JD, Ramos-Ríos R, Martínez-Formoso S, Arrojo-Romero M, Ecénarro-Tomé P. Enfermedad de Parkinson y espectro obsesivo-compulsivo. Rev Neurol. 2009;49:202-9.
7. Evans AH, Strafella AP, Weintraub D, Stacy M. Impulsive and compulsive behaviors in Parkinson's disease. Mov Disord. 2009;24:1561-70.
8. Weintraub D, Koester J, Potenza MN, Siderowf AD, Stacy M, Voon V, et al. Impulse control disorders in Parkinson disease. A cross-sectional study of 3090 patients. Arch Neurol. 2010;67:589-95.
9. American Psychiatric Association. Diagnostic and Statistical Manual of mental Disorders. 4th ed. Washington DC: American Psychiatric Association;1994.
10. Voon V, Fox SH. Medication-related impulse control and repetitive behaviors in Parkinson'disease. Arch Neurol. 2007;64:1089-96.
11. Evans AH, Katzenschalager R, Paviour D, O'Sullivan JD, Appel S, Lawrence AD, et al. Punding in Parkinson's disease: its relation to the dopamine dysregulation syndrome. Mov Disord. 2004;19:397-405.
12. Lawrence AJ, Blackwell AD, Barker RA, Spagnolo F, Clark L, Aitken MRF, et al. Predictors of punding in Parkinson's disease: results from a questionnaire survey. Mov Disord. 2007;22:2339-45.
13. Miyasaki JN, Hassan KL, Lang AE, Voon V. Punding prevalence in Parkinson's disease. Mov Disord. 2007;22:1179-81.
14. Meco G, Rubino A, Caranova N, Valente M. Sexual dysfunction in Parkinson's disease. Parkinsonism Relat Disord. 2008;14:451-6.
15. Molina JA, Sáinz-Artiga MJ, Fraila A, Jiménez-Jiménez FJ, Villanueva C, Ortí-Pareja M, et al. Pathological gambling in Parkinson's disease: a behavioral manifestation of pharmacologic treatment. Mov Disord. 2000;15:869-72.
16. Driver-Dunckley E, Samanta J, Stacy M. Pathological gambling associated with dopamine agonist therapy in Parkinson's disease. Neurology. 2003;61:422-3.
17. Lu C, Bharmal A, Suchowersky O. Gambling and Parkinson's disease. Arch Neurol. 2006;63:298.
18. Grosset KA, Macphee G, Pal G, Stewart D, Watt A, Davie J, et al. Problematic gambling on dopamine agonists: not such a rarity. Mov Disord. 2006;21:2206-8.
19. Nirenberg MJ, Waters C. Compulsive eating and weight gain related to dopamine agonist use. Mov Disord. 2006;21: 524-9.
20. Gibb WRG, Lee AJ. The revelance of the Lewy body to the pathogenesis of idiopathic Parkinson's disease. J Neurol Neurosurg Psychiatry. 1988;51:745-52.
21. Hoehn MM, Yahr MD. Parkinsonism: onset, progression, and mortality. Neurology. 1967;17:427-42.
22. Weintraub D, Hoops S, Shea JA, Lyons KE, Pahwa R, Driver-Dunckley ED, et al. Validation of the questionnaire for impulsive-compulsive disorders in Parkinson's disease. Mov Disord. 2009;24:1461-7.