

## A Study of the Impulse Control Behaviours in Persons with Parkinson's Disease

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### ABSTRACT

Impulse control disorders and related behaviours (ICD-RBs) are found in patients with Parkinson's disease. Dopamine replacement therapy, disruption in frontal lobe functions, and other idiosyncratic factors are implicated in the formation of impulse control behaviours. As the prevalence of Parkinson's disease in India is lower compared to other countries and data regarding impulse control disorders/ behaviours in the Indian setting is limited, the present study was planned for the same. **Aim:** The present study aimed to explore the presence, patterns and severity of Impulse Control Behaviours (ICBs) in the sample of patients diagnosed with Parkinson's disease undergoing treatment and its relationship with frontal lobe functions, drugs used for treatment and disease correlates. **Method:** A sample of 33 consenting patients with Idiopathic Parkinson's disorder (IPD) was chosen purposively based on the inclusion and exclusion criteria from the Movement disorders clinic at IHBAS. The QUIP-RS was used to assess Impulse-control behaviours. FAB was used to assess frontal lobe functions and the disease stage was rated on the modified Hoehn and Yahr scale. Other disease-related factors such as age at onset and medication details were obtained at the time of assessment. Data were analysed with the help of Descriptive statistics and Correlation analysis. **Results** indicate that there was the presence of significant subclinical levels of impulse-control behaviours in the sample. Hyper-sexuality and compulsive eating were the most frequently reported behaviours, whereas punding and excessive use of PD medication, were the least reported. Most of the impulsive-compulsive behaviours reported were associated with the use of dopamine agonists. No significant correlation was seen between impulse-control behaviours and frontal lobe functions as assessed on the Frontal Assessment Battery (FAB).

**Keywords:** *Parkinson's disease, Impulse control behaviours, Dopamine Agonists, Frontal Lobe Functions.*

### INTRODUCTION

Parkinson's Disease (PD) is a progressive neurodegenerative condition resulting from the death of the dopamine-containing cells of the substantia nigra. People with Parkinson's Disease classically present with the symptoms and signs associated with Parkinsonism, namely hypokinesia (ie poverty of movement), bradykinesia (ie slowness of movement), rigidity and rest tremor (Royal College of Physicians, 2006).

Although Parkinson's Disease is predominantly a movement disorder, the symptoms can be said to be neuropsychiatric which includes fluctuations in mood and anxiety, apathy, depression, psychosis, anxiety, cognitive deficits and dementia. These neuropsychiatric symptoms may have heterogeneous causes such as disease pathology, or it may be secondary to the disease, treatments, underlying comorbid disorders or individual susceptibility (Voon V, Potenza N.M & Thomson T., 2007).

### Treatment of Parkinson's disease and Impulse Control Disorders

The long-term use of Levodopa to manage the symptoms of PD leads to complications such as dyskinesia, postural instability, speech disturbance and cognitive decline (Hely et al., 2000). These

complications necessitated the need for other drugs such as Dopamine agonists (DA). Sharma et al. (2015) noted in their work that it has been recognised that dopaminergic medications (medications used to increase dopamine activity) administered to remedy motor symptoms in Parkinson's disease are associated with increased risk for Impulse control disorders and related behaviours (ICD-RBs). Some of these behaviours include hobbyism, punding, dopamine dysregulation syndrome (DDS) and walkabout. Punding refers to the performance of meaningless movements or activities (for example- Collecting, arranging, assembling and reassembling objects). Hobbyism is a type of punding that includes more complex repetitive behaviours such as gardening, painting, singing etc. which are not goal-oriented (Voon et. al., 2009). Dopamine dysregulation syndrome (DDS) is an addiction-like state marked by excessive dopaminergic medication usage, particularly L-dopa and short-acting DAs. Walkabout is defined as excessive, aimless wandering (Weintraub, 2008).

Impulse control behaviours commonly occur without subjective distress, may go unnoticed or may be hidden because the patient may experience these behaviours to be internally consistent. However, these behaviours result in psychosocial consequences that

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may be devastating for the individual (Voon, et al. 2007).

Some factors associated with ICDs in PD include younger age of onset, duration of Parkinson's disease, history of symptoms related to Impulse control disorders before the onset of PD and receiving dopamine agonists for treatment (Weintraub et al., 2006). A review of previous studies done by Voon et al. 2007 to study the prevalence of Impulse control disorders reports that hyper sexuality in PD is found in 2.4% to 8.4% of patients. The clinical manifestations of these disorders also vary in patients, for instance hyper sexuality being manifested as unrelenting sexual thoughts, promiscuity, uncontrollable masturbation, compulsive pornography, and paraphilias. (Ferrara & Stacy, 2008).

The prevalence of ICDs can also have cultural aspects. For example, compulsive gambling and compulsive shopping are found to be significantly more prevalent in the USA and Canada. Whereas the prevalence of gambling was the lowest in an Indian study (at 3.3% of subjects studied), perhaps because gambling is illegal in India (Goyal et al, 2015).

### **Frontal lobe functions and impulse control**

In Parkinson's disease impairment of executive functioning is thought to be related to cognitive deficits seen in PD which include deficits in memory, visuospatial reasoning and complex attention (Lima et al, 2008). Executive functions include processes such as planning, inhibition of responses, the performance of goal-directed activities, self-monitoring and self-regulation (Barkely RA, 2001) and these processes are mainly dependent on the frontal lobes and structures connected to them such as the thalamus and basal ganglia. The relationship between executive dysfunctions in PD and its relationship with ICD and related behaviours is controversial and requires further evidence (Cilia & Eimeren, 2011).

### **Indian Studies**

The results of Asian studies on the subject have been variable, reporting the presence of ICDs and related behaviours between 3.5% and 35%. A study done by Sarathchandran, et al in 2013 found at least 1 ICD-RB was diagnosed in 96 patients out of 305 which constitutes 31.6% of the subjects. Punding was the most frequent (15.7%), followed by compulsive buying (8.2%), compulsive eating (7.8%), hyper sexuality (5.2%), pathological gambling (4.6%), and DDS (3.3%). Punding behaviours involved making newspaper cuttings of pictures of celebrities (more common in men) or arranging and rearranging clothes, utensils, and furniture for several hours of the day (more common in women), which

differed from the classic punding behaviours reported in Western populations. Two or more ICD-RBs were observed in 7.5% of patients. Similar results were seen in a study by Goyal, et al, 2015. This was an observational cross-sectional study on impulse control disorders and related behaviours. Their findings showed that 42 % of the subjects presented with some Impulse – control behaviours and that at least one ICD was present in 25% of the subjects. Their study also supports previous findings that younger age of onset, the addition of dopamine agonists and longer duration of treatment were associated with the presence of ICD and related behaviours.

Hence it can be seen that dopamine replacement therapy and disease related factors can contribute to Impulse control disorders and related behaviours. However their presence and patterns can be influenced by personality and cultural aspects. This indicates need for further research in the Indian milieu.

### **METHOD**

**Objectives.** 1) To explore the presence, patterns and severity of impulse control behaviours in the sample of patients diagnosed with Parkinson's disease. 2) To compare the presence, patterns and severity of impulse control behaviours in the sample of patients undergoing treatment with different drugs. 3) To study the relationship between impulse control behaviours and frontal lobe functions.

**Participants:** A Sample of 33 patients diagnosed with Idiopathic Parkinson's disease (IPD) was collected using purposive sampling technique from the Movement Disorders clinic of Neurology OPD from a major Neuropsychiatric hospital of North India. The Inclusion criteria considered were – (i) Persons diagnosed with IPD between the ages of 20 and 75 years of male or female gender; (ii). Diagnosis of Parkinson's disease based on the UK Parkinson's Disease Society Brain Bank Diagnostic Criteria; and (iii). The patient must have been undergoing treatment for Parkinson's disease at the time of assessment. However, Patients with other comorbid psychiatric disorders, or having history of long term psychotropic medications had been excluded. Also Patients with Parkinson plus and secondary Parkinsonism were not included in the sample.

**Tools:** Personal Data Sheet and the Proforma for Parkinson's disease were used to keep the details of patient demographics and treatment details which included the type of drugs used for treatment, its dosage and duration and response to treatment. The **Modified Hoehn and Yahr Staging scale** was used for describing the stages of Parkinson's disease. The stages indicate progressive levels of disability in the patient. Stages 1,

2 and 3 indicate only minimal disability, whereas patients in 4 and 5 are severely disabled (Hoen&Yahr, 1967). Stage 1 refers to unilateral involvement only, usually with minimal or no functional impairment. Stage 2 indicates Bilateral or midline involvement, without impairment of balance. Stage 3 indicates the First sign of impaired righting re-flexes. This is evident by unsteadiness as the patient turns or is demonstrated when he is pushed from standing equilibrium with the feet together and eyes closed. Stage IV, fully developed, severely disabling disease; the patient is still able to walk and stand unassisted but is markedly incapacitated. Stage V indicates Confinement to a bed or wheelchair unless aided.

**QUIP- RS** (Questionnaire for impulsive–compulsive disorders in Parkinson’s disease- Rating Scale). The QUIP-RS has 4 primary questions (about commonly reported thoughts, urges/desires, and behaviours associated with ICDs), each applied to the 4 ICDs (Compulsive gambling, buying, eating, and sexual behaviours) and 3 related disorders (Medication use, punning, and hobbyism). It uses a 5-point Likert scale (score 0–4 for each Question) to gauge the frequency of behaviours and instructs patients to answer questions based on behaviours that occurred in the preceding 4 weeks (or any 4-week period in a designated time frame). Scores for each ICD and related disorder range from 0 to 16, with a higher score indicating greater severity (i.e., frequency) of symptoms. The test–retest reliability was good, with r value being >.90 and the inter-rater reliability was also found to be >.90. (Weintraub, et al. 2012). Regarding validity, adequate cut-off points (ie, both sensitivity and specificity  $\geq 80\%$ ) were determined for all 4 ICDs and hobbyism-punning. The questionnaire has four questions for each of the six categories namely a) Gambling b) Sex c) Buying d) Eating e) Performing tasks or hobbies and repeating simple activities f) Taking PD medications. For this study a seventh category was added to the questionnaire to collect information regarding any additional behaviour that might be elicited in the Indian population, keeping in mind the idiosyncratic nature of these behaviours and also the impact of culture, based on the review of the literature.

**FAB** (Frontal Lobe Assessment Battery). The FAB consists of **six** subtests exploring the following: conceptualization, mental flexibility, motor programming, sensitivity to interference, inhibitory control, and environmental autonomy. FAB has been shown to have good inter-rater reliability ( $\kappa = 0.87$ ,  $p < 0.001$ ), and internal consistency (Cronbach's coefficient alpha = 0.78). FAB correlated with dysfunction in a variety of cognitive domains including attention, memory, and executive

functions. The FAB was concluded to have added value over the MMSE, particularly among non-demented patients. Kopp et.al. 2013 report several FAB scores (including composite and item scores) provide valid measures of right hemispheric lateral frontal lobe dysfunction.

**Procedure.** All participants were informed about the purpose of the study. After taking written informed consent, persons diagnosed with Idiopathic Parkinson’s disease (IPD) based on the UK Parkinson’s Disease Society Brain Bank Diagnostic Criteria at the Movement Disorders clinic at IHBAS were taken for the study. Patients who refused to participate, were excluded and their treatment procedure was not affected in any manner. Each subject's disease stage was rated based on the Modified Hoen and Yahr staging scale. Demographics, details regarding symptoms and treatment were obtained. The details of the medications were obtained with the help of the neurology consultant. Thereafter, the QUIP-RS was administered. The scale was clinician-rated and it was done in a semi-structured interview format. Information was obtained from the client as well as the informants, wherever possible and wherever necessary. Thereafter the frontal assessment battery was administered.

#### **Results Analysis of data:**

Data were analysed using descriptive statistics and Statistical Package for Social Sciences (SPSS) 22.0. Descriptive statistics were used to analyse data regarding the demographic details of the patient and treatment details associated with impulse-control behaviours. Correlation analysis was used to find the relationship between impulse control behaviours and frontal lobe functions.

In the study sample, 15 out of 33 (N=33, 19 males and 14 females) patients were screened to be having some kind of impulse control behaviours, constituting 45.45% of the entire sample. Out of the 15 patients having impulse control behaviours, 10 are male and 5 are female. Thus it can be observed in the presented data that twice the number of males were screened positive for ICBs when compared to females.

Concerning the frequency and type of impulse control behaviours, it was seen that the domain of behaviours involving preoccupation with sex has received the maximum frequency, followed by eating and lastly the use of PD medications. None of the patients reported thoughts related to Gambling. Thoughts related to punning-hobbyism were also not reported by any of the patients.

In the total sample (n=33), 13 patients were taking Syndopa along with one Dopamine agonist and 20 were on treatment with only Syndopa. Of the 15 patients

who screened positive for ICBs, 9 out of them were on treatment with a DA in combination with Syndopa. Hence out of the 13 patients on DA treatment in the sample, 9 had some form ICBs, whereas only 6 out of 20 patients undergoing treatment with Syndopa at the time of assessment had ICBs. Hence, treatment with DA was presented with a higher frequency in patients with some form of ICBs. This is consistent with previous literature. The Data are presented in Table 1.

**Table 1:** Showing the presence of ICBs based on the type of drugs used for the treatment of PD

Drugs for treatment	Frequency	Percentage
Syndopa	6	18.18%
Syndopa with DA	9	27.27%
Total	15	45.45%

DA: Dopamine Agonists

For the next objective of the study, no significant correlations were seen between the scores on QUIP-RS and FAB i.e., no significant correlation was found between impulse-control behaviours and frontal lobe functions, as measured on the Frontal assessment battery. Also, no significant correlations were seen between impulse-control behaviours and other disease-related factors such as age at onset, disease stage and duration of treatment, although some previous studies have found younger age of onset to be associated with impulse-control disorders. Table 2 depicts the data.

**Table 2:** Table showing the correlation between impulse control behaviours and other domains

	QUIP	FAB	Age at onset	Disease Stage	Duration of Treatment
QUIP r	1.000	.182	-.195	-.214	-.188
p	.	.278	.278	.232	.294
N	33	33	33	33	33

\*p<.05

QUIP: scores on QUIP-RS FAB: Frontal assessment battery

**DISCUSSION**

**Patterns and severity of Impulse control behaviours**

As mentioned earlier there are very few Indian studies that have described the prevalence rates of ICBs in PD. In the present study, it was seen that 45.45% (15 out of 33) patients were reported to have some kind of impulse control behaviour present. This includes thoughts, urges and behaviours. This result is similar to study done in AIIMS, Delhi. Sharma et.al, in 2015 found that at least one Impulse control-related behaviour was present in 128 patients out of the 229 which comprises 42.8% of the clinical population studied. This result supports the finding that the

presence of such behaviours in the Indian population is comparable to those found in Western countries. Although the current study limits itself to studying impulse control behaviours only and did not identify disorders using further interviews. Hence the high percentage (45%) indicates the presence of any behaviour that fell under the purview of the QUIP-RS regardless of its classification as a disorder.

In the present study the following percentages for the different classes of Impulse control behaviours were found. Based on the score on QUIP-RS, the highest scores were obtained on Eating (30%) as 10 patients (6 males and 4 females) out of 33 patients screened positive in this area. Hyper-sexuality was only positive for men (6 out 33) patients, comprising 18.18 % of the total sample. Both males and females screened positive for Items related to PD medications, comprising 9.09% (1 male and 2 female) of the sample. Finally, only female patients screened positive for Punding (2 females) and Buying (1 female) comprising 6.06 % and 3.03% of the sample respectively. None of the patients screened positive for pathological gambling.

These results at first look contradictory to the earlier findings. Sharma et. al,2015 in their study found that Punding was the most frequent (12.4%) followed by hyper sexuality (11.04%), compulsive hobbyism (9.4%), compulsive shopping (8.4%), compulsive medication use (7.7%), compulsive eating (5.35%), walkabout (4%) and pathological gambling (3.3%). Another Indian study done previously by Sarathchandran et.al, 2013 also showed similar results.

However, the difference in the present study could be explained by the choice of tool. Sharma et.al, 2015 in their study used the QUIP which uses the yes or no format of the answer; whereas the present study used the QUIP-RS which uses a Likert-type scale and has four different questions to rate the gradations of behaviours. The previous studies reported the presence of Impulse control behaviours only, whereas the present study also looks at the pre-occupation and urges that may be preceding these behaviours. In the present study only 1 out of 10 patients screened positive on the item describing difficulty in controlling behaviour which comprises 3.03% of the total sample. This percentage is closer to that reported in earlier studies for the presence of behaviours related to eating. Similarly for Hyper sexuality, only 2 patients reported difficulty in controlling these behaviours which accounts for 6.06% of the total sample. Other factors that may help explain the higher percentage of behaviours but not disorders in the sample could be psychological such depression, anxiety and a sense of isolation. These behaviours are also being looked upon

now as coping mechanisms to manage the adverse effects of the disease (Delaney et. al., 2012).

### **Patterns and severity based on the drugs being used for the treatment of PD**

Another objective of the study was to see the pattern and presence of ICBs based on the type of drugs being administered for the treatment of PD. From the sample of 33 patients, 20 patients were under Syndopa monotherapy whereas 13 patients were taking Syndopa and Dopamine Agonist (DA) during the time of assessment. Of the 15 patients screened positive for ICBs, 9 were on Syndopa and DA therapy and 6 were on Syndopa monotherapy.

Consistent with findings in the previous studies, 5 out of 6 male patients screening positive for hypersexuality behaviours were on DA therapy with Syndopa.

One patient who reported positive compulsive buying behaviours was also on DA therapy. Voon & Susan in 2007 found that previous studies that systematically assessed medication associations along with comparisons with PD control subjects, pathological gambling, hypersexuality, and compulsive shopping in PD were robustly associated with the use of dopamine agonists as a class but not with any specific agonists.

However, not all patients subjected to DRT show signs of Impulse control behaviours. This points towards individual susceptibility that may be accounted for by (1) the neurobiology of PD. Biology can also be modulated by temperamental traits or underlying cognitive processes. (2) specific medication practices, or (3) individual factors underlying the vulnerability to pathological gambling, addiction disorders, or impulse control behaviours (Voon et. al., 2007) and psychological factors as mentioned previously.

### **Impulse control behaviours and their relationship with frontal lobe functions**

The last objective of the present study was to explore the relationship of the impulse control behaviours with frontal lobe functions. The results of the study show that although there is a positive correlation between the frontal lobe functions as measured by the FAB and the Impulse control behaviours however, this relationship is weak ( $\rho = .182$ ) and non-significant ( $p = .312$ ,  $p > .05$ ).

On the FAB, higher scores indicate better frontal lobe functioning and lower scores indicate worsening of the frontal lobe functions. On the QUIP-RS, higher scores indicate increasing frequency and severity of the impulse control behaviours. So the positive correlation seems to be counterintuitive which would mean that better frontal lobe functions are

associated with ICBs. However in the current sample 28 out of 33 patients have obtained scores that are either below the cut-off point or just at the cut off (score of 12) on FAB and 53% of patients who presented with ICBs had a FAB score at or below the cut off. The mean score on the FAB for the sample was 9.42, which is below the cut-off point. This indicates that for the majority of the patients in the sample, some difficulty in frontal lobe functioning was present. In the other words, even though there is a positive correlation between the FAB scores and QUIP-RS, this still indicates correlation between impairment of frontal lobe functions and ICBs.

This finding is consistent with previous research done in the field. It is seen that PD patients who undergo Dopamine replacement therapy (DRT), especially with DA are found to have impaired cognitive functions. In the present study 6 out of 8 of those patients whose FAB scores are at or below the cut-off point were on DA at the time of assessment.

This is thought to happen through the following mechanism. First, PD leads to a loss of dopaminergic neurons in the substantia-nigra, resulting in a pronounced depletion of dopamine in the nigrostriatal pathway (Bjarkam & Sorensen 2004 in Weintraub, 2008). Second, PD patients, even those without dementia, commonly display a range of impairment in executive abilities (Green, McDonald, Vitek et. al., 2002). This impairment has been linked to degeneration in the striatal-frontal tracts secondary to cell loss within the substantia nigra (Brand, Labudda, Kalbe et. al., 2004). A study done in 2007 by Frank et. al that involved administration of computerized decision-making tasks to PD patients on and off PD medications, the medicated group showed impairment in the ability to learn from negative decision outcomes, a psychological deficit that also may have relevance to the maintenance of ICD behaviours. Regarding differential effects of PD medications, there is also some evidence that DA, but not L-dopa, treatment impairs executive abilities in patients with early or mild PD (Brusa et. al., 2003 in Weintraub, 2008).

However this relationship of dopamine with executive functions is not a simple one and most likely not the only mechanism responsible for the disruption of cognitive functions in PD patients. Zgaljardic, Foldi, Mattis in 2003 in 'A Review of the Cognitive and Behavioral Sequelae of Parkinson's Disease: Relationship to Fronto-striatal Circuitry' found that patients with PD who were under dopamine withdrawal also demonstrated impaired performance on frontal/executive neuropsychological tests. Hence they opined that dopamine might be indirectly associated

with cognitive and behavioural dysfunctions in Parkinson's disease.

Secondly literature suggests that different neural pathways may better explain the dissociation of the motor from the cognitive and behavioural symptoms. That is, while some circuits mediate motor disruption, others connecting the basal ganglia with the frontal cortex may be implicated in the cognitive and behavioural profile of PD because similar impairments were exhibited by patients with PD and by those with focal frontalsystem lesions (Dalley et.al., 2007).

Moreover, although cognitive functions are known to be affected in PD, especially the executive functions, some of this also reflects the inconsistencies in tools that are being used to measure it. Different tests have varied abilities to assess cognitive function (Torralva, 2009; Kehagia et.al, 2012). Other cortical regions other than the frontal lobes have also been implicated in mediating performance on the executive function tasks (Struss & Alexander, 2000). This has been documented in other studies where unlike the original study by Dubois et.al.(2000) which showed no correlation between FAB and other cognitive tests, subsequent studies failed to replicate these findings suggesting that performance on the FAB does not reflect frontal function exclusively (Castiglioni et al., 2006 ; Lipton et al., 2005 ). This may help explain why in the current study also even though there have implications of executive functions playing a role in impulsive behaviours have been shown, no significant correlations was brought out in the study, between FAB measured executive functions and Impulse-control behaviours.

### CONCLUSIONS AND CLINICAL IMPLICATIONS

There is a presence of significant subclinical levels of impulse-control behaviours in the sample. Hypersexuality and compulsive eating were the most frequently reported behaviours, whereas punning and excessive use of PD medication use were the least common. Most of the impulsive-compulsive behaviours reported were associated with the use of dopamine agonists. No significant correlation was seen between impulse-control behaviours and frontal lobe functions as assessed on the Frontal Assessment Battery (FAB).

The study gives empirical validation to the previously done Indian studies on the subject that there are the presence of impulse –control related behaviours in patients diagnosed with PD, even though it may exist at at-subclinical levels. However, it highlights the importance of making specific enquiries into these behaviours and discussing the same with patients and their caregivers, as these behaviours may not be

reported due to shame, denial or lack of awareness. It may help with the diagnosis of ICDs, if they may develop in the future and help clinicians monitor and manage the treatment. Further more, psychological factors play a role in these behaviours and needs to be further researched.

### LIMITATIONS

The first limitation that has been observed is that the data sample was small. This limits the generalizability of the data and prevented from rigorous statistical analysis. The analysis was based majorly on descriptive statistics and studying the correlation between few factors. The other factors such as the personality factors such as impulsivity were not included in the study.

### FUTURE DIRECTIONS

Further research should aim to have greater sample size. Different tools can be used to study frontal lobe functions which are more precise at tapping different areas that the frontal assessment battery does not include. Since there are gradations observed in the impulse control behaviours, and there are differences in the patient perception related to the behaviours (ego-syntonic and ego-dystonic) phenomenological studies can be carried out to study the boundaries of these behaviours and also to improve accuracy in understanding the clinical manifestation of these behaviours.

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