

Spectrum and Burden of Movement Disorder Conditions in a Tertiary Movement Disorders Centre—A 10-Year Trend

Kar Mun Eu,¹, Louis CS Tan,²MBBS, FRCP(UK), FAMS(Neurology), Amanda RJ Tan,²MSc, Irene SH Seah,², Puay Ngoh Lau,², Wei Li,², Wing Lok Au,²MRCP (UK), FAMS(Neurology), FRCP(Edin), Kay Yaw Tay,²MBBS (Malaya), MRCP (UK)

Abstract

Introduction: The precise burden of movement disorder conditions in our movement disorders centre is unclear. This study investigated the clinical burden of the Movement Disorders Clinic (MDC) in National Neuroscience Institute (NNI) over 10 years, aiming to identify the burden and spectrum of movement disorders conditions, to facilitate future resource allocation. **Materials and Methods:** We identified all patient visits from January 2002 to December 2011 at MDC from the Movement Disorders (MD) database using a standardised data collection form. **Results:** There was a linear increase in the clinical burden of MDC during this period. Parkinsonism comprised 71.6% of this clinical burden of which 84.8% were Parkinson's disease (PD) patients. Dividing the incident cases of MD conditions into two 5 years' blocks, the proportion of PD cases had not changed. There was significant increase in time to diagnosis for PD, hemifacial spasm and dystonia. **Conclusion:** There was nearly 4-fold increase in the burden of movement disorders conditions in our tertiary condition within a decade. However, we did not find increasing proportion of PD cases which would be in line with an ageing population. This could be due to the fact that we are still in the early stages of an ageing population and we postulate that this proportion will go up in the future. The increased time to diagnosis may indicate increasing waiting time to see a movement disorders specialist and that current outreach effort to promote awareness may not be reaching its target audience. The upward trend of clinical burden indicates a need for increased resource allocation to cope with demand for movement disorders services.

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Key words: Clinical burden, Movement disorder, Parkinson Disease, Tremor

Introduction

Movement disorders refer to a group of neurological conditions that cause either hyperkinetic or hypokinetic movements. Movement disorders are common. As an example, the prevalence of Parkinson's disease (PD) exceeds 1% in individuals aged 60 and above with increasing rates found amongst older individuals.¹ The prevalence rate of essential tremor is 4% in individuals over the age of 40 and the rate increases to 14% in those over the age of 65.^{2,3} These conditions largely afflict the elderly and their occurrence is expected to increase in Singapore as a result of our ageing population.

Although the prevalence and incidence rates of PD⁴ and hemifacial spasm⁵ in Singapore had been published previously, the burden of movement disorders as a whole is

unclear. Furthermore, the spectrum of movement disorders conditions seen in our tertiary centre has not been analysed. A better understanding of the burden and spectrum of movement disorders will facilitate more accurate manpower projections and resource allocations in this field. Hence, we undertook this study to understand the burden, trends and spectrum of patients with movement disorders in Singapore.

Materials and Methods

Study Population

We used the Movement Disorders (MD) database to identify all patient visits to the Movement Disorders Clinic (MDC) of National Neuroscience Institute (NNI) from January 2002 to December 2011. The MD database was

¹Yong Loo Lin School of Medicine, National University of Singapore, Singapore

²Department of Neurology, National Neuroscience Institute, Singapore

Address for Correspondence: Dr Tay Kay Yaw, Department of Neurology, National Neuroscience Institute, 11 Jalan Tan Tock Seng, Singapore 308433.

Email: kay_yaw_tay@nni.com.sg

started in 2002 and since then, clinical and demographic information of all patients attending the MDC has been captured onto it, at each clinic visit, using a standardised data collection system. The database and study received approval from the institutional ethics committee. In our centre, PD was diagnosed based on the NINDS diagnostic criteria for PD,⁶ multiple system atrophy was diagnosed based on the consensus statement on the diagnosis of multiple system atrophy⁷ and progressive supranuclear palsy was diagnosed based on NINDS-SPSP clinical criteria.⁸ A standardised data collection form was used to retrieve demographic information for movement disorders conditions such as parkinsonism, tremor, myoclonus, and dystonia from the MD database. We examined the clinical burden, which is defined as the number of clinic visits over 10 years. We had used this definition as we felt that it was appropriate to tag clinical burden to the clinic visits as this would reflect the subvention that our institution received from the Ministry of Health in Singapore and therefore our capability to increase manpower. The number of incident cases or first patient visits were also tabulated and classified according to diagnosis. The age of onset and time to diagnosis (duration from symptom onset to diagnosis) were also analysed.

Data Analysis

Descriptive statistics, t-test, chi-square test and Mann-Whitney test were performed where appropriate using SPSS version 2.0.

Results

Clinical Burden

There was an upward trend in the clinical burden over the past 10 years, with increases observed almost every year (Fig. 1). The clinical burden had increased nearly 4-folds from 2002 (1238 clinic visits) to 2011 (4697 clinic visits). Parkinsonism had the highest clinical burden (71.64%), followed by myoclonus (9.43%), tremors (6.47%)

and dystonias (5.32%) respectively. These 3 disorders represented 87.54% of the clinical burden. Looking into clinical burden per physician ratio, we noted that there was an increase from a ratio of 619 clinic visits per physician in 2002 to 1371 clinic visits per physician in 2011. Among the common neurological diseases in our institution, clinical burden in the movement disorders subspecialty was the highest compared to stroke and dementia services. There were 4697 clinic visits for the MD subspecialty compared to 2711 clinical visits and 1241 clinical visits for stroke and dementia services respectively. We further compared clinical burden per physician among these 3 conditions as this will reflect the workload more accurately. Clinical burden per physician in the movement disorders, stroke and dementia subspecialty were 1371, 677 and 1241 clinic visits respectively in the year 2011. This difference is statistically significant ($P < 0.001$). To better quantify manpower needs, we also looked into the differences between numbers of visits per patient per year for early PD compared to advanced PD. We defined early PD as Hoehn and Yahr stage 2.5 and below, and advanced PD as Hoehn and Yahr stage 3 and above. We used this definition because in our opinion, patients with postural instability with a tendency to fall tend to prefer spaced out clinical visits due to the inconveniences of transportation to the hospital. Comparing clinical visits per year for early and advanced PD patients, we noted no differences in their frequency (2.40 vs 2.52; $P = 0.47$).

PD had the highest clinical burden (19,494 clinic visits in 10 years), comprising 84.8% of the clinic burden among patients diagnosed to have parkinsonism. This was followed by multiple system atrophy (940 visits) and progressive supranuclear palsy (854 visits), comprising 4.1% and 3.7% of the parkinsonism clinical burden respectively. The proportions of clinical burden of the different parkinsonian syndromes had remained fairly constant over the last 10 years.

Essential tremor was the most common condition among those who were diagnosed with a tremor syndrome

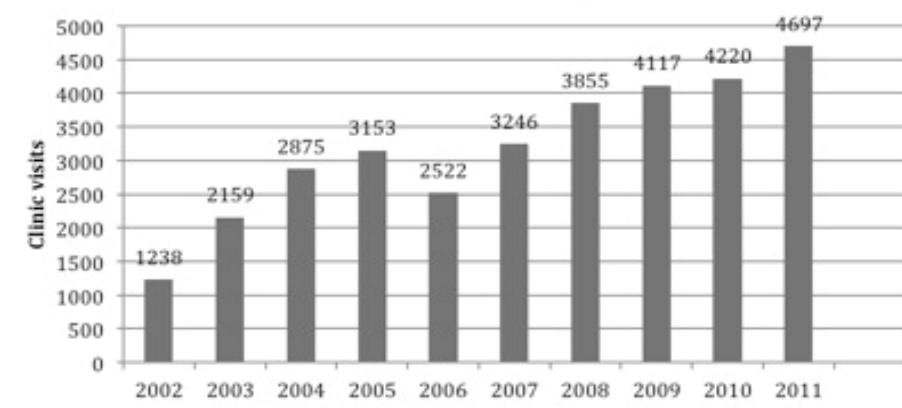


Fig. 1. Chart showing the clinical burden of movement disorders over 10 years.

(excluding tremor associated with parkinsonism syndromes), with 1783 clinic visits, or 85.9% of the tremor clinical burden. This was followed by enhanced physiological tremor (5.4%). Hemifacial spasm was the predominant diagnosis in the myoclonus group of movement disorders with 2921 visits, or 96.6% of the myoclonus clinical burden (Table 1, Fig. 2).

Incident Parkinsonism Cases

There were 3748 incident cases, or new cases, seen at the NNI MDC from 2002 to 2011. Patients with parkinsonism contributed the largest portion, with 2084 (55.60%) new cases. This was followed by tremors, with 610 cases

(16.28%), myoclonus with 347 cases (9.26%) and dystonia with 222 cases (5.92%).

There were 1503 new PD cases from 2002 to 2011, accounting for 72.12% of new parkinsonism cases. This was followed by drug-induced parkinsonism (111 cases), multiple systems atrophy (111 cases) and vascular parkinsonism (105 cases) (Table 2). We further divided the incident parkinsonism cases into 2 blocks of 5 years' period to compare if there were any differences between causes of parkinsonism. We observed an upward trend in the proportion of newly identified drug-induced parkinsonism cases nearing statistical significance (3.89% vs 6.53%, $P = 0.054$) (Table 2). The other causes of parkinsonism were not significantly different between the two 5 years' period.

Age of Onset

The median age of onset of PD among our patients was 65.8 years. Among 1459 PD patients with known age of onset, 156 (10.70%) patients had an age of onset of less than 50 years (young onset PD). There was no significant

Table 1. Clinical Burden of Movement Disorders

Disease	n (% of Disease Clinical Burden in Disorder Category)
Parkinsonism (22,985 clinic visits)	
Parkinson's disease	19,494 (84.8)
Multiple system atrophy	940 (4.1)
Progressive supranuclear palsy	854 (3.7)
Tremors (2075 clinic visits)	
Essential tremor	1783 (85.9)
Myoclonus (3024 clinic visits)	
Hemifacial spasm	2921 (96.6)

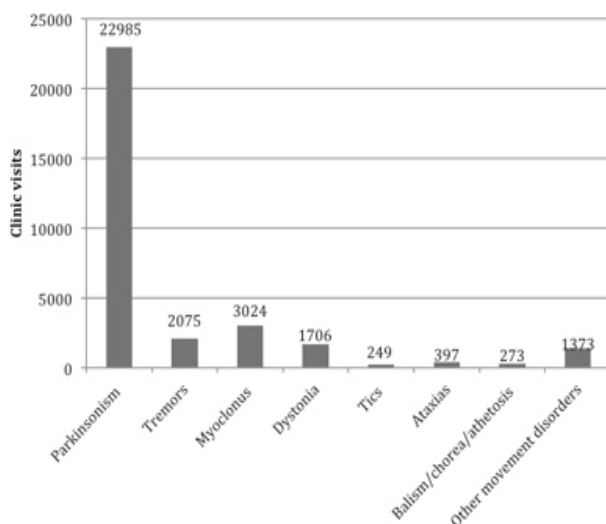


Fig. 2. Chart showing the clinical burden of movement disorders categories over 10 years.

Table 2. Incident Cases of Parkinsonism Cases over 10 Years

Disease	2002 to 2006, n (%)	2007 to 2011, n (%)	Total in 10 year, n (%)
Parkinson's disease	709 (74.6)	794 (70.0)	1503 (72.1)
Drug-induced parkinsonism	37 (3.9)	74 (6.5)	111 (5.3)
Multiple systems atrophy	59 (6.2)	52 (4.6)	111 (5.3)
Vascular parkinsonism	44 (4.6)	61 (5.4)	105 (5.0)
Atypical parkinsonism	28 (2.9)	74 (6.5)	102 (4.9)
Progressive supranuclear palsy	38 (4.0)	42 (3.7)	80 (3.8)
Cortico-basal-ganglia	21 (2.2)	16 (1.4)	37 (1.8)
Normal pressure hydrocephalus	10 (1.1)	10 (0.9)	20 (1.0)
Diffuse Lewy body disease	2 (0.2)	9 (0.8)	11 (0.5)
Post-encephalitic parkinsonism	2 (0.2)	1 (0.1)	3 (0.1)
Toxicant-induced parkinsonism	1 (0.1)	0 (0)	1 (0.1)
Total	951	1133	2084

difference in the proportion of incident cases of young-onset PD patients in the first half of the study decade compared to the second half ($P = 0.524$). The median age of onset for the other major parkinsonism syndromes were progressive supranuclear palsy (65.3 years), corticobasal syndrome (66.9 years) and diffuse dementia with Lewy bodies (73.1 years).

The median age of onset for the other common movement disorders such as essential tremor, dystonia and hemifacial spasm were 47.4, 47.2 and 51.3 years respectively (Fig. 3). We did not find any change in the average age of onset for these disorders over the 10 years of data.

Gender and Racial Distribution

There were more males than females with PD and essential tremor ($P = 0.0007$). We also observed significantly more females with hemifacial spasm ($P = 0.0154$) (Fig. 4).

Singapore is a multiethnic country, comprising 74.1% Chinese, 13.4% Malays, 9.2% Indians according to the 2010 population census. In our MDC, Chinese patients were over-represented and Malays and Indians were under-represented for PD, essential tremor, dystonia and hemifacial spasm.

Time to Diagnosis

We also studied the time to diagnosis as this could reflect the degree of disability from the symptoms of various movement syndromes, as experienced by the local population. PD had the shortest time to diagnosis, with patients presenting at a median of 11 months after the onset of disease. Hemifacial spasm and dystonia had similar time to diagnosis, at 12 months and 12.5 months

respectively. Patients with essential tremor had the longest time to diagnosis, with a median of 42.8 months. The median time to diagnosis in 2007 to 2011 was significantly higher than the median time of diagnosis in 2002 to 2006 for PD ($P = 0.0221$), hemifacial spasm ($P < 0.0001$) and dystonia ($P = 0.0210$).

Discussion

Our study showed an ever-increasing clinical burden at the NNI MDC, with a 4-fold increase from 2002 to 2011. We postulated that this could be due to an increase in population in Singapore in the last decade. We also postulate that with an ageing population in Singapore, diseases that mostly affect the elderly such as PD, will see an increasing trend over other movement disorders patients. This is similar to a worldwide trend, a study projected that the number of individuals with PD will double from 4.1 – 4.6 million in 2005 to 8.7 – 9.3 million by 2030 in Europe's 5 most populous nations and the world's 10 most populous nations.⁹ However, we noted that the clinical burden of parkinsonian disorders had not grown in proportion relative to the clinical burden of all movement disorders in our study. This could be due to the fact that we are still in the early stages of an ageing population and incidence has yet to peak. Hence, we would expect the clinical burden of parkinsonian disorders to have an absolute increase, as well as an increase relative to the other movement disorders in an ageing population in the years to come.

Parkinsonism disorders comprised the highest number of incident cases. As expected, PD comprised the most number of incident cases consistent with other studies.^{10,11}

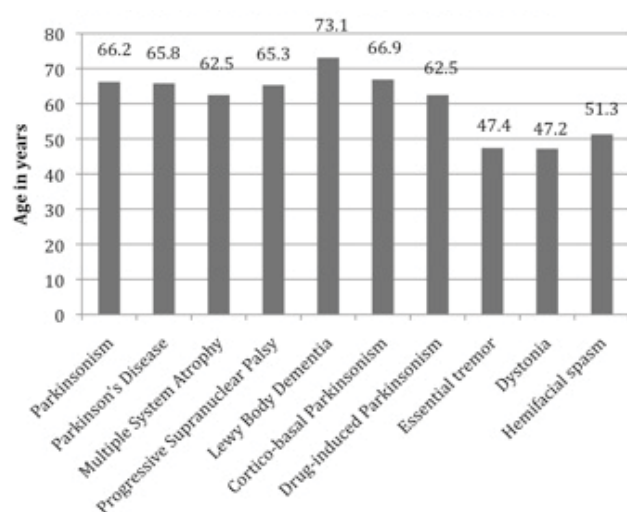


Fig. 3. Chart showing the age of onset of common movement disorders conditions.

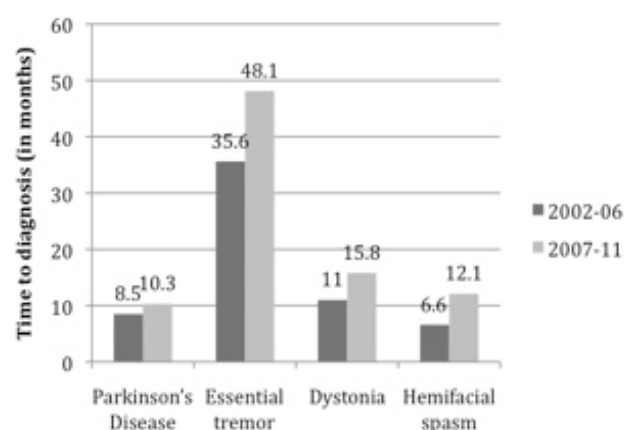


Fig. 4. Chart showing the median time to diagnosis for common movement disorders conditions.

In a study done by Tan et al, it was estimated the age and sex-adjusted (US 1990 population) incidence rate to be 32 per 100,000 person years for individuals aged 50 years and above.⁴ The actual incidence rate in the local population is likely to be slightly higher as individuals younger than 50 years were not included in that study. In our study population, 10.70% of incident PD cases had an age of onset of less than 50 years.

As mentioned previously, PD was the most common parkinsonian disorder, with incident cases comprising 72.1% of all incident parkinsonism cases in our centre. This was followed by drug-induced parkinsonism (5.33%), and multiple systems atrophy (5.33%). The proportion of progressive supranuclear palsy and cortico-basal-ganglia is 3.84% and 1.78% respectively. This differed from the proportions observed in other studies. In a prospective cohort study performed in the Netherlands, the proportion of PD was 51%, parkinsonism associated with dementia 18%, drug-induced parkinsonism 12%, cerebrovascular disease 5%, multiple system atrophy or progressive nuclear palsy 2% and parkinsonism unspecified 12%.⁷ In a retrospective study performed in the States, the proportion of PD was 42%, drug-induced parkinsonism 20%, parkinsonism in dementia 14%, and 7% with other causes.¹¹ Looking into the differences, we noted that PD carried a higher than expected proportion of our parkinsonism patients while dementia with Lewy bodies was rarely seen in our movement disorders centre. We postulated that the differences observed may be due to racial differences, differences in exposure to environmental risk factors, or differences in study methodology.¹² Another possible explanation is that a large number of dementia with Lewy bodies patients in our institution received treatment at the memory clinic, hence data for these patients were not captured in the MD database. Hence, further studies need to be done to evaluate the exact incidence and prevalence of various parkinsonian disorders in our local population.

We observed an increasing trend in the percentage of drug-induced parkinsonism cases over 2002 to 2011 that almost reached significance ($P = 0.054$). The percentage of drug-induced parkinsonism cases among parkinsonism cases was 3.89% (2.7% to 5.1%, 95% SI) between 2002 and 2006, and increased to 6.53% from 2007 to 2011 (5.1% to 8.0%, 95% SI). This may be due to better recognition of drug-induced parkinsonism from the use of antipsychotic, thus causing a spike in incident cases. Another explanation may be due to an increased use of drugs that induces parkinsonism such as antipsychotics and other antidopaminergic medications (e.g. metoclopramide and prochlorperazine), which were frequently used in the treatment of dizziness in Singapore. There may be a benefit to increase awareness of drug-induced parkinsonism among healthcare providers who will be prescribing these drugs in order to reverse this trend.

We observed a statistically significant increase in the time to diagnosis for PD, essential tremor, and dystonia in 2007 to 2011 as compared to 2002 to 2006. This was unexpected, as we postulated that there would be a decrease in the time taken due to the following reasons—an increasingly educated and affluent society that would in turn lead to increased health literacy, and outreach efforts to promote awareness of movement disorders such as PD. There were several reasons that could explain this increase in the time to diagnosis for the conditions above. Diagnosis of PD and dystonia in Singapore are usually made in the specialised movement disorders clinic. Referral to these clinics from the general practitioners were limited by the availability of slots in a physician's clinic. Our data showed that clinic visits per physician ratio had increased from 619 clinic visits in 2002 to 1371 clinic visits in 2011 and thus the increase in the waiting time to see a movement disorders specialist and the delay in making a definitive diagnosis. Another explanation for this increase in the time to diagnosis was that existing outreach efforts may be reaching out to those who were already aware of PD, rather than a wide swathe of the population. Future outreach efforts should be geared to increase awareness in those who would otherwise not be aware of this disease. There can also be initiatives to improve knowledge of movement disorder conditions among primary care practitioners, who are first line in patient care. A previous survey of Singapore general practitioners found that there is poor level of awareness in the identification and presence of alternative parkinsonian conditions.¹³ The early detection of movement disorders such as PD is important as it may lead to a reduction of severe cases at presentation and mortality.^{14,15}

Our study has several limitations. Singapore has other tertiary hospitals with neurology departments that also care for movement disorder patients. Hence, trends observed in NNI may not be representative countrywide. However, NNI is an institute dedicated to neurological conditions that sees a substantial portion of patients with neurological patients from the central part of Singapore, and so the trends observed are likely to be representative of the general population. This is a retrospective study based on data in the MD database. It was not practicable to review the medical records of all our patients to confirm the findings in the database. However, the information has been prospectively entered after each clinic visit and previous audits on the database have found the information collected to be accurate.

Conclusion

Despite these limitations, this is a comprehensive review of the cases seen in a movement disorders clinic over a period of 10 years. It is the first to describe the clinical burden of movement disorders in Singapore. Our study revealed a

trend of increasing burden of movement disorders, and is likely to increase further in coming years. This indicates a need for more resources to be allocated in order to cope with an increasing demand for movement disorders services.

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