

**CROSS SECTIONAL STUDY OF NEUROLEPTIC INDUCED MOVEMENT DISORDERS
IN PATIENTS ATTENDING THE PSYCHIATRIC OUT PATIENT DEPARTMENT OF
TERTIARY CARE HOSPITAL**

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ABSTRACT

Background: Neuroleptic-induced movement disorders (NIMDs) are a significant adverse effect associated with the long-term use of antipsychotic medications. These disorders can adversely impact the quality of life, medication adherence, and overall prognosis in psychiatric patients. Despite their clinical importance, NIMDs often remain under-recognized and underreported, especially in outpatient settings. **Objective:** To assess the prevalence, types, and associated risk factors of neuroleptic-induced movement disorders among patients receiving antipsychotic treatment in the Psychiatric Outpatient Department of Government General Hospital. **Methods:** A cross-sectional observational study was conducted on psychiatric patients attending the outpatient department who were on neuroleptic medication for at least three months. Standard diagnostic tools such as the Abnormal Involuntary Movement Scale (AIMS), Simpson-Angus Scale (SAS), and Barnes Akathisia Rating Scale (BARS) were used to identify and categorize movement disorders including tardive dyskinesia, drug-induced parkinsonism, and akathisia. Demographic and clinical data were collected and analyzed to identify potential risk factors. **Results:** Among the study population, the overall prevalence of NIMDs was found to be significant, with tardive dyskinesia being the most commonly observed disorder, followed by parkinsonism and akathisia. Older age, longer duration of antipsychotic therapy, use of typical antipsychotics, and higher cumulative doses were identified as major contributing factors. **Conclusion:** Neuroleptic-induced movement disorders are prevalent among psychiatric outpatients on antipsychotic therapy and warrant regular monitoring. Early detection and appropriate management strategies, including dose adjustment or switching to atypical antipsychotics, are essential to minimize the burden of these disorders and improve patient outcomes.

KEYWORDS: Neuroleptic-induced movement disorders, tardive dyskinesia, drug-induced parkinsonism, akathisia, antipsychotics, cross-sectional study, psychiatric outpatient.

INTRODUCTION

Neuroleptic induced movement disorders is a traditional term that refers to impaired motor control, usually referable to dysfunction of the basal ganglia. NIMD (neuroleptic induced movement disorders) are the most common adverse events related to antipsychotic treatment. NIMD negatively affect the quality of life of psychotic patients. Identification of risk factors, biological substrate and treatment options for NIMD is necessary to improve the outcomes and safety of antipsychotic therapy.^[1]

The likelihood of causing NIMD with an SGA exists and depends on many factors. The patient's characteristics (age, gender, marital status, educational status and concomitant conditions), history of the disease, previous treatment, the choice of a particular antipsychotic, its dose, and duration of treatment and adjuvant therapy should be taken into consideration in the order to minimize the risk of NIMD and provide the best quality of care. Hence the extrapyramidal side effects to be properly diagnosed and appropriately treated so that there is increased compliance and efficacy of the medications.

Antipsychotic drugs are commonly used in various conditions, including schizophrenia, psychosis, mania, depressive disorders and mood disorders.

The four types of drug induced NIMD are akathisia, parkinsonism, tardive dyskinesia and dystonia. Early symptoms, including akathisia and dystonia, occur within the first few days or months of treatment, while late symptoms, such as tardive dyskinesia, may appear after a few years of antipsychotic therapy.^[1]

The term "neuroleptic" meaning "to fix or hold a neuron" was used to describe the neurological adverse effect of conventional antipsychotics rather than their therapeutic effects. Antagonism of dopamine (D2) receptors is involved not only in antipsychotic effects, but also in causing extra pyramidal symptoms.^[2]

Factors for Tardive dyskinesia were Old age, Female sex, Brain damaged individuals, cumulative neuroleptic dose, duration of exposure, Presence of drug induced Parkinsonism in the early phase of neuroleptic treatment, Primary psychiatric diagnosis of affective disorder and substances including alcohol. The risk factors leading to akathisia were poorly understood; though it is noted more with high potency antipsychotics possibly due to employment of higher dose.

Middle aged Women are at greatest risk.^[3, 4, 5] Risk Factors for Development of Drug- Induced Parkinsonism were High dose, high-potency drug use; elderly, female sex, hereditary susceptibility and Coexistence with tardive dyskinesia.^[6]

AKATHISIA

Akathisia is a frequent and serious adverse effect of treatment with antipsychotic drugs. It includes 50% of extrapyramidal symptoms and is considered one of the most common movement disorders caused by antipsychotics. It consists of motor restlessness accompanied by subjective feelings of inner tension and discomfort, mainly in the limbs. It may coexist with Parkinsonian symptoms, but may be more common, and symptoms can be distressing and cause poor adherence to treatment. It usually appears within the first few days of treatment. Sometimes it may develop only as higher doses are achieved. It may also appear as early as 12 hours after the initiation of therapy. There are other data suggesting that rapidly increasing doses of high potency antipsychotic medication markedly increases the development of akathisia. Akathisia may also be caused by antiemetics, serotonergic agents, serotonin reuptake inhibitors and cocaine.

The patients suffer from the feeling of restlessness and an irresistible urge to move. They describe a very upsetting experience of pressure, nervousness, tension, increased motor activity consisting of complex, often meaningless stereotyped and repetitive movements. Symptoms commonly seen are lower-limb movements, rocking from foot to foot, shuffling of legs, or swinging one leg over the other while sitting. In severe akathisia, patients may pace up and down or they may be unable to feel comfortable in any position, such as sitting, lying, or standing, for more than a few minutes. Trunk rolling and fidgeting movements of the upper limbs may also be seen.

The prevalence of akathisia varies from 5 to 36.8% among extra pyramidal side effects. Akathisia occurs in 10% to 20% of patients treated with atypical antipsychotics, which is less than 20% to 52% with typical antipsychotics. Akathisia may persist for the duration of antipsychotic therapy and usually ceases after the discontinuation of antipsychotics.^[2,7]

There have been early studies in young adult mentally ill patients and the elderly that suggest that their occurrence can be associated with a significantly increased risk of tardive dyskinesia.

Chronic akathisia. Akathisia may also be seen in those receiving maintenance antipsychotic treatment. The accompanying subjective sense of restlessness may be less intense in chronic akathisia. In a relatively small number of people, repetitive restless movements characteristic of akathisia may not be accompanied by any sense of inner restlessness or compulsion to move. This is called pseudo akathisia and is more common in male and older patients, and may coexist with negative symptoms and tardive dyskinesia.

Mechanism of development of akathisia. The mechanism of development of akathisia is not well

understood. It is postulated that it is due to dopamine receptor blockade in brain areas other than the striatum. When akathisia occurs alone in the absence of Parkinsonian symptoms, it may be due to dopaminergic blockade in the mesocortical tract rather than in the nigrostriatal pathway. Other neurotransmitters, including central adrenergic systems, may also be involved.

Rating scales to measure akathisia. The most widely used scale for akathisia is the Barnes rating scale for drug induced akathisia. It differentiates between restlessness and any associated distress.^[7]

Drugs that induce akathisia

The rough estimation is that about 25% of patients treated with FGAs develop akathisia, but it is also common with SGAs. Some researchers suggest that akathisia rates do not differ between FGAs and SGAs. It was previously suggested that SGAs clozapine and quetiapine carry the lowest risk for akathisia, yet it was not confirmed in some blinded reviews. Also, the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) study as a randomized, partially open label study in which efficacy and side effects of multiple SGAs with an FGA perphenazine showed that akathisia remains a problem with SGAs, though at lower rates compared to FGAs. Based on CATIE study, it appeared that risperidone and perphenazine, for example, both cause akathisia in 7% of patients.^[7]

PARKINSONISM

Drug induced Parkinsonism is the most common especially in elderly patients. The duration between the start of the antipsychotic drugs and onset of the symptoms are variable which may range from few days to few months.

It is characterized by the triad of bradykinesia, muscle rigidity and tremor. Postural tremor is more common than resting tremor. Tremor of the lips and perioral muscles can be observed, which is called as “rabbit syndrome”. The main symptoms of Parkinsonism include muscle rigidity, tremors, bradykinesia, postural abnormalities, and salivation. The development of symptoms is dose dependent and emerges in about 20 to 40 percent of patients. With continuation of medication, the Parkinsonian symptoms may gradually subside and tolerance may develop. Rigidity of the limbs resistant to passive movement is the most obvious feature of drug-induced Parkinsonism. It may take on two forms: lead-pipe rigidity with sustained resistance or cog-wheel rigidity with a succession of resistance rapidly overcome by passive movement. Milder forms of rigidity are best detected on activation. The rigidity is more obvious when the subject is engaged in moving the opposite limb. Tremor and bradykinesia are seen as well. However, there are other symptoms less commonly observed, such as festinant gait, 3 to 5 Hz resting tremor, or a reduction in the size of handwriting. Patients who have used antipsychotics, the prevalence is about 15%.

Parkinsonism is considered as a reversible condition usually lasts up to 4 months. In some cases it may last up to 6-18 months. 15% antipsychotics induced Parkinsonism is said to be persistent.

Mechanism of development of Parkinsonism. Drug-induced Parkinsonism is closely analogous chemically to idiopathic Parkinson's disease or its post encephalopathy variety. The blockade of dopamine receptors within the striatum amounts to chemical denervation resulting in relative dopamine deficiency.

Rating scales of Parkinsonism. There are a number of rating scales including Chouinard's extrapyramidal rating scale, the targeting abnormal kinetic effects (TAKE), the extrapyramidal symptoms (NIMD) scale, and the neurological rating scale for extrapyramidal side effects (Simpson-Angus scale). The Simpson-Angus scale was the first to be developed and remains the most widely used. This scale provides standardized ratings for rigidity, tremor, and salivation. The scale is entirely sign led and overemphasizes rigidity. It has only one item for tremor, and bradykinesia is measured only indirectly through the item on gait.^[2,7]

DRUGS THAT INDUCE PARKINSONISM

Although switching to SGAs is often recommended in cases of Parkinsonism, the rates of Parkinsonism induced by SGAs (e.g., 26% with olanzapine) are lower than those with the FGAs (55% with haloperidol), but not negligible. Other evidence shows virtually no advantages of SGAs compared to FGAs in relation to Parkinsonism as an adverse effect, especially when the potency and dose are considered. It was shown that high doses of SGAs (such as olanzapine, risperidone, or quetiapine) caused Parkinsonism in high doses at a similar rate a slow-potency FGA (chlorpromazine), but the risk was 50% higher in high-potency FGA group. At the 12-month follow up, covariate-adjusted rates of Parkinsonism were 37%– 44% for SGAs and 37% for perphenazine. However, the choice of an intermediate-potency FGA (perphenazine) as a comparator in modest doses in CATIE could probably be responsible for the lack of significant difference between FGAs and SGAs regarding incidence of Parkinsonism.

TARDIVE DYSKINESIA

Tardive dyskinesia is manifested by involuntary choreoathetoid movements of the orofacial region, extremities, trunk and respiratory muscles. The movements are more pronounced with excitement, and disappear during sleep. Sometimes the patients set up their mind to decrease the intensity of the involuntary movements and succeed in doing but only short time. Significant number of patients does not notice these involuntary movements or are not bothered by them. Tardive dyskinesia (TD) is the main late onset condition among the NIMDEs. It develops after chronic exposure to antipsychotics for about six months. There are involuntary movements, mainly of the tongue and mouth

with twisting of the tongue, chewing, and grimacing movements of the face. Symptoms include orofacial dyskinesia's that involves protrusion or twisting of the tongue, smacking and pursing of lips, puffing of lips, chewing movements of the jaw, grimacing movements of the face. Limb and truncal movements include purposeless, jerky, choreiform movements, athetosis of the extremities, limb and axial dystonia's, gait abnormalities. Age is the most consistent risk factor for TD. It is also more common in female patients. Other risk factors include affective disorder, poor treatment response, previous brain injury, greater total drug exposure, pre-existing Parkinsonism, and alcoholism. It may be seen in up to 30 percent of patients receiving long-term conventional antipsychotics. Tardive dyskinesia can occur in all patients treated with antipsychotics. It develops after months or years of continuous use of antipsychotics. Tardive dyskinesia can also persist after the discontinuation of antipsychotics or may even be irreversible. The incidence of tardive dyskinesia associated with typical antipsychotics therapy in long-term studies is 5% per year in adults and cumulative annually 25-30% in the elderly. With atypical antipsychotics treatment, the incidence of tardive dyskinesia is significantly lower.

Risk factors for occurrence of tardive dyskinesia include elderly patients as well as female patients with brain damage, dementia, mood disorders, increased duration of antipsychotic therapy, and use of anticholinergic drugs, antiparkinsonism drugs and previous occurrence of extra pyramidal symptoms.^[2,7] Movements indistinguishable from TD, especially orofacial ones, are seen in 5 to 15 percent of elderly individuals who have never been on antipsychotics.

These spontaneous movements are also seen in about seven percent of antipsychotic naïve schizophrenic patients at the onset of their illness. TD is a diagnosis of exclusion, so before making this diagnosis, other causes of abnormal movements should be excluded.

Mechanism of development of TD. The exact mechanism of TD is not known. The prolonged blockade of dopamine receptors may lead to TD by virtue of increased dopamine turnover, coupled with upregulation of receptor numbers, resulting in an imbalance between D1 and D2 receptors. The hypersensitivity of D2 receptors may cause them to respond abnormally to the dopamine reaching them. Hypersensitivity of this nature may account for the worsening of the condition on withdrawal of antipsychotics and amelioration on their reintroduction.

Animal studies have shown that with prolonged administration, dopamine receptor blockade may actually slowly disappear, giving way to super sensitivity. It is likely that complex interactions with other neurotransmitters like GABA may in part be responsible.

Rating scales of TD. The 12-item abnormal involuntary movement scale (AIMS) is the most popular instrument used to assess TD. Other scales like tardive dyskinesia rating scale (TDRS) and extrapyramidal rating scale are also commonly used. AIMS assesses abnormal involuntary movements, including orofacial movement, extremity, trunk, and other body regions.^[7]

DRUGS THAT INDUCE TARDIVE DYSKINESIA

While most of the previously conducted studies showed that the risk of TD with SGAs is one-quarter that of FGAs, the results of this study suggest that the risk with SGAs is more than half that of FGAs(excluding clozapine patients)or more than two-thirds of the risk (including clozapine patients). The finding of surprisingly high rate of TD among clozapine patients in this study was attributed to certain confounding factors, such as confounding by indication (prescribing of clozapine to patients with TD or at-risk for TD), and should be interpreted with caution.

In CATIE study, patients with TD were excluded from being randomized to perphenazine treatment. There were no statistically significant differences in the rate of new onset TD across the group of antipsychotic drugs. The rates ranged from 13% (quetiapine) to 17% (perphenazine) .Since patients in the FGA (perphenazine) group were free from previous TD, CATIE study does not enable true comparison between FGAs and SGAs regarding TD, but it offers some valuable insight into predisposing factors for TD registered as baseline. These factors are older age, previous exposure to FGA and anticholinergic medication, previous longer antipsychotic treatment, and acute NIMD.⁷ Antipsychotic drugs are associated with adverse effects that can lead to poor medication adherence, stigma, distress and impaired quality of life. Among the various side effects of anti-psychotics neuroleptic induced movement disorders constitute one of the important side effects interfering with the compliance of the patients towards medication. The movement disorders associated with antipsychotics are disabling and distressing and result in behavioural disturbances (violence and aggression), nonadherence, and exacerbation of psychosis. Numerous studies have examined the incidence and severity of extrapyramidal syndrome with first- and second-generation antipsychotics. These movements are very obvious to the observer and add to the stigma of psychiatric illness.

It is hence very important that a careful evaluation of these symptoms be made in all patients treated with antipsychotics, so that the balance between potential risks and benefits may be optimized. Rating scales may be used to achieve this purpose. Our study focuses on the evaluation of the commonly seen movement disorders with the help of NIMD examining scales and to remind health professionals that NIMD remain a significant concern with the use of antipsychotic drugs.

METHODOLOGY

1) STUDY AND STUDY DESIGN: The present study is a cross sectional observational study which was conducted in Tertiary Care Hospital, among the patients attending the psychiatry outpatient department.

2) STUDY DURATION: The study was conducted for duration of 6 months.

3) PARTICIPANTS

a) SAMPLE SIZE

A sample composed of 580 psychiatric patients from Government General Hospital who were diagnosed with psychiatric disorders. Informed consent given by the patient or their caregiver was procured before administration of scales

b) INCLUSION CRITERIA

- Patients age over 18 years
- Patients diagnosed with psychosis, depressive psychosis, bipolar disorder with psychosis, seizures with psychosis, alcoholic dependence syndrome and being treated
- Patients receiving antipsychotic medication at least from more than 2 weeks
- Patients who gave written informed consent are enrolled in the study

c) EXCLUSION CRITERIA

- Newly diagnosed psychiatric patients
- Patients who are acutely ill
- Psychotic patients not compliant with medication
- Patient not diagnosed with any psychiatric disorders

4) ETHICAL CONSIDERATIONS

The study is approved by Institutional Ethical Committee

5) SAMPLING TECHNIQUE

It is a consecutive sampling that involved the assessment of NIMD caused by antipsychotic medications.

6) STUDY INSTRUMENTS

Semi structured socio demographic proforma

A specially designed intake proforma is used for assessing the socio-demographic and clinical profile of the patients.

SOCIO-DEMOGRAPHIC AND CLINICAL PROFILE

A self-prepared semi structured proforma was used to collect the data on age, gender, OP number, education, occupation, marital status, habits and family history of psychiatric illness in first and second degree relatives, Symptoms, diagnosis, duration of illness, past medical and medication histories, medical comorbidities, duration of treatment, prescription details and other medications.

As it consists of 2 components, age, gender, OP number, education, occupation, marital status, habits and family history of psychiatric illness in first and second degree relatives, Symptoms, diagnosis, duration of illness, past

medical and medication histories, medical comorbidities are recorded in socio demographic profile.

Treatment details including duration of treatment, prescription details and other medications are recorded in clinical profile.

SCALES USED

The following scales are used to assess the NIMD in subjects on antipsychotics.

A) Barnes akathisia rating scale

Barnes akathisia scale was made up of three items with the following classifications: objective evaluation from zero (absent) to three (constant akathisia); subjective assessment that has two sub items, restlessness perception and discomfort associated with restlessness, from zero (absent) to three (severe); Global akathisia evaluation from zero (absent) to five (severe), and it was developed to measure dyskinetic symptoms in patients taking antipsychotic drugs.^[23] For akathisia, It is envisaged that the rating on the global item alone should be sufficient for diagnostic purposes, and for measuring change in the overall severity of akathisia in response to treatment. Nevertheless, to rate the global item accurately the elements of the three other items need to be taken into account, and these items should be completed first.^[27]

B) Simpson angus NIMD rating scale

Simpson and Angus rating scale was used for extrapyramidal effects, comprising ten items in a scale from zero (absent) to four (severe). Each item brings instructions to assess and specify severity of each symptom.^[23] SAS is a 10 item rating scale that has been used widely for assessment of NIP in both clinical practice and research settings. it consists of 1 item measuring gait, 6 items measuring rigidity and 3 items measuring glabella tap, tremor and salivation respectively.^[27]

C) Abnormal involuntary movement scale

Abnormal Involuntary Movement Scale (AIMS) was used to measure dyskinetic symptoms in patients taking antipsychotic drugs comprising 12 items, on five point severity scale ranging from 0 to 4. Total scores are not generally reported. Instead, changes in global severity and individual areas can be monitored over time. Ten items cover the movements themselves, divided into sections rating global severity and those related to specific body regions; two items concern dental factors that can complicate the diagnosis of dyskinesia.

In the presence of extended neuroleptic exposure and the absence of other conditions causing dyskinesia, mild dyskinetic movements in two areas or moderate movements in one area suggest a diagnosis of tardive dyskinesia.^[23]

The threshold value for Akathisia was a Barnes scale

total score of 2 or more (scale range=0–5); for Parkinsonism, the threshold value was a Simpson-Angus Rating Scale mean global score of 0.3 or more (scale range=0–4). For the diagnosis of Tardive dyskinesia, a minimum global rating of "mild" (i.e. 2 or more on AIMS item no. 8), was used.^[6]

7) PROCEDURE

This is a cross sectional observational study conducted at psychiatric outpatient clinic of a government general hospital. Every consecutive patient who comes to the psychiatric OPD with diagnosis of psychosis, bipolar affective disorder (BPAD) with psychosis, depression with psychosis, epilepsy with psychosis, alcoholic dependence with psychosis, are considered for the study. The diagnosis is done by qualified psychiatrist associated with the study based on ICD-10 criteria. Patients on antipsychotic medication are approached and are explained the study and those who gave written informed consent, inclusion and exclusion criteria are applied on them and are enrolled in the study.

Those who cannot give history by themselves, if representative is present with them who can give adequate history are considered for the study. Only the patients who are on antipsychotic treatment for more than 2 weeks and are compliant with the treatment are included. Compliance is taken as those who do not have skipped the medication for more than 2 days are considered. Those who are acutely ill, those who didn't give consent, who don't have informant who can give adequate history of illness and with movement disorder prior to starting of antipsychotics are excluded from the study.

Once the patient is enrolled in the study, each informant is given a serial number and relevant history is taken. The researcher involved in the study applies a sociodemographic proforma which involves the collection of socio demographic clinical proforma which includes diagnosis, treatment, number of antipsychotics given, other medications, duration of illness, duration of treatment and if any extrapyramidal symptoms present at the onset of current treatment. After collection of patient data, necessary scales are applied on the patient in the presence of psychiatrist. With the help of these scales (SAS, AIMS, BARS), the NIMD (PARKINSONS, TARDIVE DYSKINESIA, AKATHISIA) are assessed.

To familiarize the researchers on scales, there is an orientation period of 2 weeks during which scales are explained in detail by psychiatrist and also the application of scales is taught on neutral subjects before applying it on patient, according to the response given by the patient, the scoring is given. Then the patient is told to meet the psychiatrist for pre advice and scoring has to be mentioned by the researcher.

To assess Parkinson's disease, The Simpson Angus scale was used.^[29,30,31] Akathisia was evaluated using Barnes

Akathisia Rating Scale.^[27] tardive dyskinesia is measured by AIMS (Abnormal involuntary movement symptoms) scale.^[30,32,33]

The different types of NIMD, their severity and the awareness of these symptoms by the patient were assessed. The threshold value for akathisia was a Barnes scale total score of 2 or more (scale range=0–5).^[27,30] for Parkinsonism, the threshold value was a Simpson-Angus Rating Scale mean global score of 0.3 or more (scale range=0–4) (29, 30) or 0.65 or more,^[29] But we took 0.3 as cut off score value for our study. Cases of tardive dyskinesia were defined by the AIMS according to Schooler-Kane criteria, which require at least moderate dyskinetic movements in one body area or mild dyskinetic movements in two body areas.^[30,32,33]

8) DATA COLLECTION

Data were obtained from the patient's chart, through interviews with patients, who voluntarily agreed to participate in the study after signing an informed consent form, using questionnaire forms prepared by the researchers i.e., socio demographic clinical proforma. The data collected was grouped, and subjected to statistical analysis and tabulated. The results are presented in absolute and percent numbers, as figures and tables.^[23]

9) DATA ANALYSIS

Descriptive analysis was performed to depict patient characteristics using chi-square test. To investigate the relationship between NIMD and factors such as age, duration of disease, use of antipsychotics as mono or poly therapy, the obtained data was analysed using chi square test.

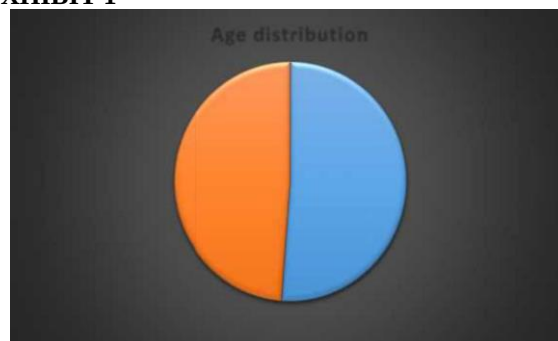
SOCIO DEMOGRAPHIC VARIABLES

AGE

The minimum age of the sample was 18 years and maximum was 60 years.

The majority of the sample belonging to the age group of 18-40 years and followed by 40 to 60 years.

EXHIBIT 1



Age distribution.

GENDER

Out of 580 who were enrolled in the study, 298 were male and 282 were female

EXHIBIT 2

GENDER DISTRIBUTION



EMPLOYMENT

274 were employed, 306 were unemployed at the time of inclusion in the study.

EXHIBIT 3

Distribution of socio-economic status



MARITAL STATUS

31% of the subjects were married, 24% were unmarried, 23% were divorced/separated and 22% were widowed.

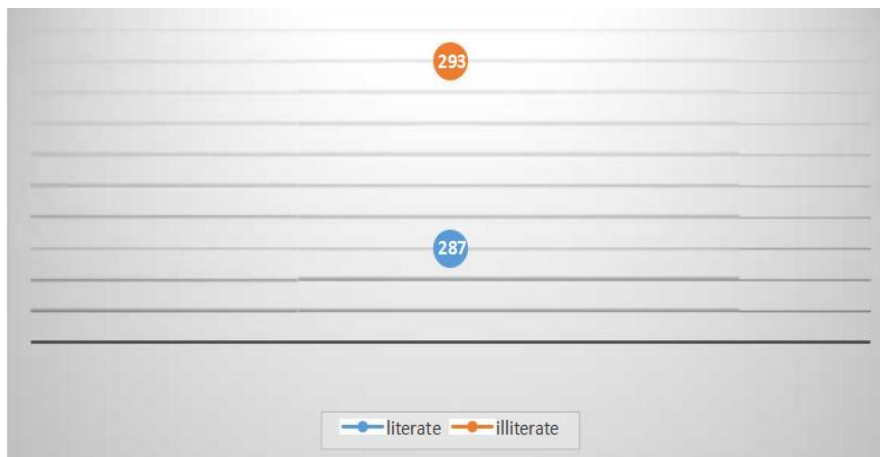
EXHIBIT 4



LEVEL OF EDUCATION

Majority of the sample comprised of illiterates(51%),while 49% of sample were literate.

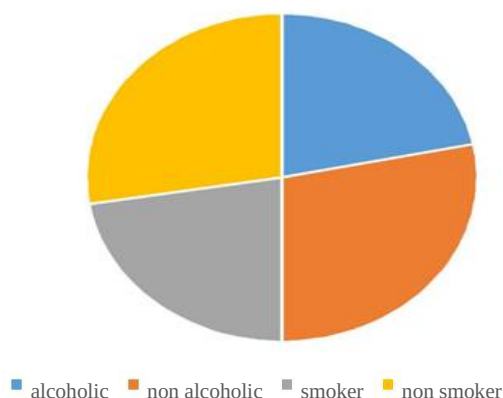
EXHIBIT 5



SUBSTANCE ABUSE

Out of total sample, 21% are alcoholic,27% were non-alcoholic,22% were smokers,27% were non-smokers.

EXHIBIT 6



Out of 580 subjects who completed the study 64(11.03%) suffered NIMD. It was observed that majority of the patients with psychotic NIMD problems were male 37(6.3%) followed by female 27(4.6%).The

frequency of most common symptoms in the sample were NIP (8.1%), akathisia (6.7%) and tardive dyskinesia (3.1%).

Table1: Distribution of NIMD in total sample.

S. No	NIMD	NIP	AKA	TD
1	PRESENT	51(8.7%)	39(6.7%)	18(3.1%)
2	ABSENT	529(91.2%)	541(93.2%)	562(96.8%)

Out of 580 subjects, 64 subjects suffered NIMD. Out of 64, 8.7% had NIP, 6.7% had akathisia, and 3.1% had TD.

516 patients didn't have NIMD.

Table 2: Frequency of NIMD

S. No	NIP	AKA	TD
1	80%	61%	28%

Among 64 NIMD patients, the distribution of NIP was 80%, akathisia was 61%, and TD was 28%

Table 3: Socio Demographic Characteristics of subjects suffering from NIMD.

FACTORS		NIP	AKATHISIA	TD
AGE	≤20	2(0.3%)	1(0.1%)	0
	21-40	27(4.6%)	27(4.6%)	15(2.5%)
	41-60	21(3.6%)	15(2.5%)	11(1.8%)
	>60	2(0.3%)	2(0.3%)	0
GENDER	FEMALE	18(3.1%)	19(3.2%)	12(2%)
	MALE	35(6%)	26(4.4%)	13(2.2%)
OCC	EMP	20(3.4%)	8(1.3%)	16(2.7%)
	UNEMP	33(5.6%)	30(5.1%)	16(2.7%)
EDU	LIT	23(3.9%)	23(3.9%)	11(1.8%)
	ILLIT	30(5.1%)	21(3.6%)	16(2.7%)
MAR	MAR	32(5.5%)	24(4.1%)	17(2.9%)
	UNMAR	12(2%)	9(1.5%)	4(0.6%)
	DIV	6(1%)	7(1.2%)	3(0.5%)
	WIDOW	3(0.5%)	3(0.5%)	2(0.3%)
HABITS	ALC	5(0.8%)	4(0.6%)	2(0.3%)
	SMO	9(1.5%)	7(1.2%)	4(0.6%)

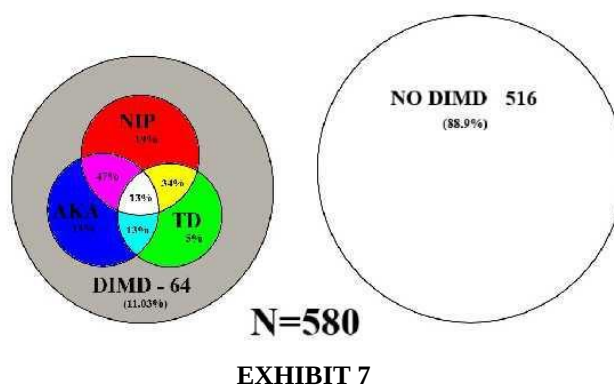
Baseline demographic and clinical characteristics of the study population are summarized in Tab. 3

Table 4: Severity of NIMD.

AKATHISIA			TARDIVE DYSKINESIA			NIP	
MILD	MOD	SEV	MILD	MOD	SEV	≥0.3	≥0.65
17(2.9%)	18(3.1%)	4(0.6%)	5(0.8%)	11(1.8%)	2(0.3%)	51(8.7%)	26(4.4%)

Out of 39(6.7%) Akathisia Cases, 43% of Individuals Have Mild Akathisia, Moderate Akathisia in the 46% Individuals, and Severe Akathisia in the 10% Individuals. Out of 18(3.1%) TD Cases, 27% of Incidence of Neuroleptic induced movement disorders.

Individuals have mild TD, 61% have moderate TD, And 11% have severe TD. 51(8.7%) subjects have NIP using 0.3 as cut off score and 26(4.4%) subjects have NIP using 0.65 as cut off score



The above graph demonstrated that one psychiatric patient may exhibit a combination of different NIMD, while the most common combination includes various forms of hyperkinetic or hypokinetic movement disorders. The patients with NIMD were 11.03% and those without NIMD are 88.9%. There was an overlap seen between TD and NIP with 34% whereas, 47% of overlap was seen in between akathisia and NIP and 13% of overlap between akathisia and TD and amongst the 3,

the overlap was found to be 13%. And out of 64 NIMD patients, the patients with only NIP were 19%, the patients with only TD were 5% and the patients with only akathisia were 14%. And the patients without any one of the NIMD were 88.9%.

N=TOTAL SAMPLE(580)

P value * (<0.05) is considered as significant association.

The statistical analysis of potential factors contributing to NIMD is presented in Tabs. 4–11.

Table 5: Comparison of association between Age and NIMD.

NIMD	AGE GROUP			
	18-40 (Present)	18-40 (Absent)	41-80 (Present)	41-80 (Absent)
TD	15(2.5%)	282(48.6%)	11(1.8%)	272(46.8%)
NIP	29(5%)	268(46.2%)	23(3.9%)	260(44.8%)
AK	28(4.8%)	269(46.3%)	17(2.9%)	266(45.8%)

Chi=10.03; p=0.12.

The above table shows the frequency of neuroleptic induced movement disorders by age. The extrapyramidal symptoms were seen more common in the individuals of the age group 21-40 years with 6.2% ,followed by 41-60 years with 3.9%, >60 years with 0.5% and in patients

below 20 years with 0.3%.The extrapyramidal symptoms were seen least in the age group of 18-20 years. The p value was found to be 0.12 which indicates the difference between NIMD and different age groups was not significant.

Table: 6 Comparison of association between gender and NIMD.

NIMD	FEMALE(282)		MALE(298)	
TD				
	Present	Absent	Present	Absent
NIP				
	13(2.2%)	269(46.3%)	13(2.2%)	285(49%)
AKA				
	18(3.1%)	264(45.5%)	35(6%)	263(45.3%)
	19(3.2%)	263(45.3%)	26(4.4%)	272(46.8%)

Chi=12.1; p=0.05.

The above table shows that out of 282(48.6%) female subjects, 13 (2.2%) subjects have TD, 18(3.1%) have NIP, 19(3.2%) have akathisia.

Out of 298 (51.3%) male subjects, NIP is more common

with 6%, followed by 4.4% with akathisia and 2.2% with TD.

The presence of NIMD were highly among males than in females.

CHI square test and p value for above table were 12.1 and 0.05 respectively which shows that there is no

Significant association between gender and NIMD.

Table 7: Comparison of association between Occupation and NIMD.

NIMD	OCCUPATION			
	EMPLOYED(274)		UNEMPLOYED(306)	
	(Present)	(Absent)	(Present)	(Absent)
TD	7(1.2%)	267(46%)	11(1.8%)	295(50.8%)
NIP	19(3.2%)	255(43.9%)	32(5.5%)	274(47.2%)
AKA	14(2.4%)	260(44.8%)	25(4.3%)	281(48.4%)

Chi=16.6; p=0.01*

Among the sample belonging to low socio economic status, there was more NIMD were found when compared to sample belonging to high socio economic status. The above table shows that 274 subjects are

employed and 306 are unemployed. CHI square and p values are 16.6 and 0.01 respectively that shows that these findings were statistically significant.

Table 8: Comparison of association between marital status and NIMD.

NIMD	MARITAL STATUS							
TD	MARRIED (180)		UNMARRIED (139)		SEPARATED (132)		WIDOWED (129)	
	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)
TD	12 (2%)	168 (28.9%)	3 (0.5%)	136 (23.4%)	4 (0.6%)	128 (22%)	1 (0.17%)	128 (22%)
NIP	31 (5.3%)	149 (25.6%)	10 (1.7%)	129 (22.2%)	6 (1%)	126 (21.7%)	4 (0.6%)	125 (21.5%)
AKA	23 (3.9%)	157 (27%)	8 (1.3%)	131 (22.5%)	6 (1%)	126 (21.7%)	2 (0.3%)	127 (21.8%)

The sample were grouped into 4 categories based on their marital status: currently married, unmarried, separated or divorced and widowed. Above table shows the frequency of persistent movement disorders by marital status. Married sample had higher rate of NIMD symptoms whereas, widowed sample had lower rate of NIMD. In married, unmarried, separated, divorced subjects, the most commonly seen NIMD was NIP with 5.3%, 1.7%, 1%, 0.6% respectively, followed by

akathisia with 3.9%, 1.3%, 1% respectively and least observed is TD with 2%, 0.5%, 0.6%, 0.17% respectively.

The chi square tests and p values of presence and absence of NIMD with marital status were found to be 1.26 and 0.97, and 0.5 and 0.99 respectively. Therefore there is no significant association between marital status and NIMD.

Table 9: Comparison of association between Education and NIMD.

NIMD	EDUCATIONAL STATUS			
	LITERATE(287)		ILLTERATE(293)	
	(Present)	(Absent)	(Present)	(Absent)
TD	8(1.3%)	279(48%)	10(1.7%)	283(48.7%)
NIP	23(3.9%)	264(45.5%)	28(4.8%)	265(45.6%)
AKA	20(3.4%)	267(46%)	19(3.2%)	274(47.2%)

Chi =16.9; p=0.009*.

The above table shows the chi square value and p value of educational status and NIMD were 16.9 and 0.009

respectively. Hence educational status was a significant correlate.

Table 10: Comparison of association between Social History and NIMD.

NIM	HABITS			
	ALCOHOLICS		NON ALCOHOLICS	
D	(252)	(328)	(260)	(320)

Smoking and alcohol use was significantly higher in the age group <50 years. The above table shows that out of total sample of alcoholics, non-alcoholics, smokers and non-smokers the most commonly seen NIMD is NIP with 1%, 7.5%, 1.3%, 6.2% respectively, followed by akathisia with 0.5%, 6.2%, 1%, 5.1% respectively and

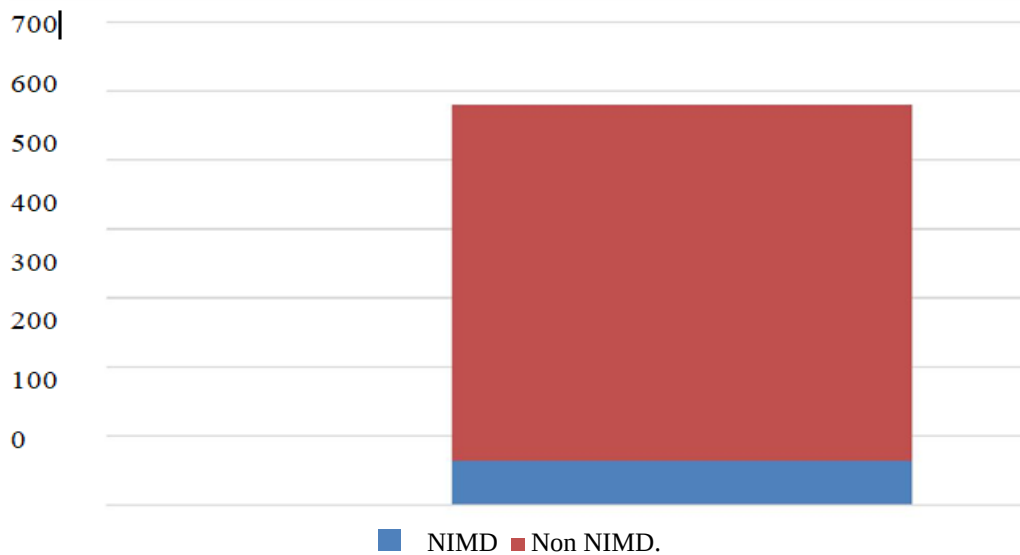
least observed NIMD is TD with 0.5%, 2.5%, 0.5%, 2.2% respectively. The chi square value and p value of above table were found to be 1.12 and 0.98, and 0.8 and 0.99 for presence and absence of NIMD respectively which indicates that there is no significant association between habits (alcohol, smoking) and NIMD.

Table 12: Comparison of association between duration of treatment and NIMD.

Duration of treatment	TD	NIP	AK
3m-1yr	19(0.7%)	6(1.0%)	4(0.6%)
2yrs-5yrs	8(1.3%)	17(2.9%)	11(1.8%)
6yrs-15yrs	4(0.6%)	17(2.9%)	15(2.5%)
>15yrs	7(1.2%)	4(0.6%)	7(1.2%)
CHI=26.09 P=0.0002*			

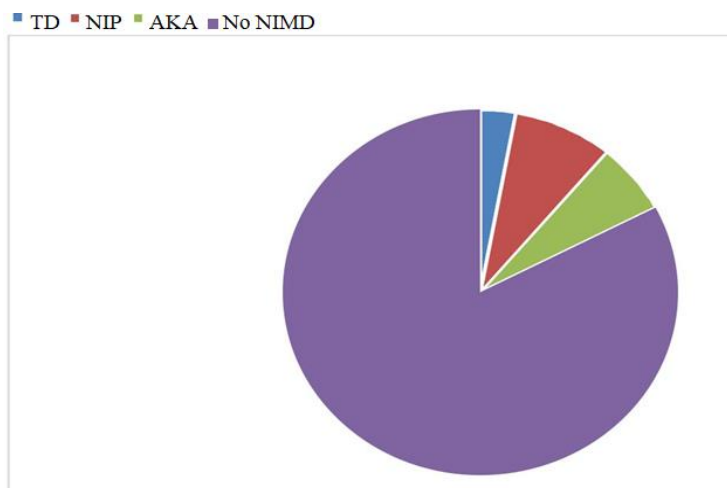
Based upon chi square values and p values of above table, there is a significant association between duration of treatment and NIMD. More NIMD are observed in subjects treated between 3 months to 1 year.

DISTRIBUTION OF NIMD AMONG TOTAL SAMPLE
EXHIBIT 8



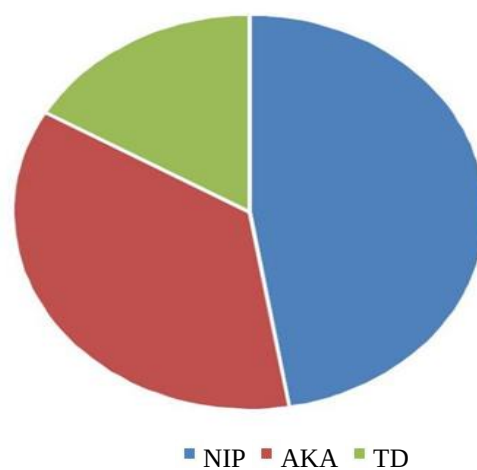
DISTRIBUTION OF TD, AKATHISIA AND NIP AMONG TOTAL SAMPLE
EXHIBIT 9

NIMD



DISTRIBUTION OF TD, AKATHISIA AND NIP AMONG NIMD
EXHIBIT 10

NIMD



DISTRIBUTION OF NIMD AMONG DIFFERENT AGE GROUPS

EXHIBIT 11

■ AKA ■ NIP ■ TD

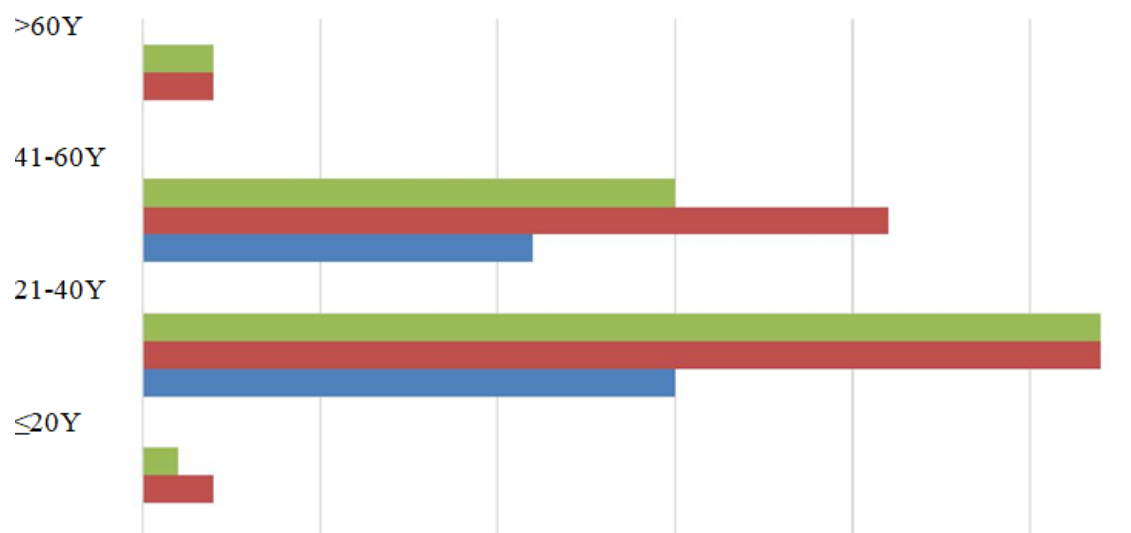
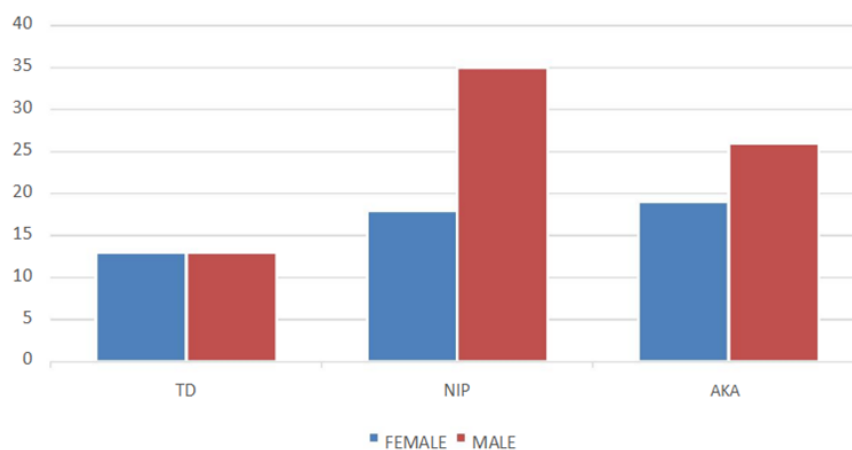


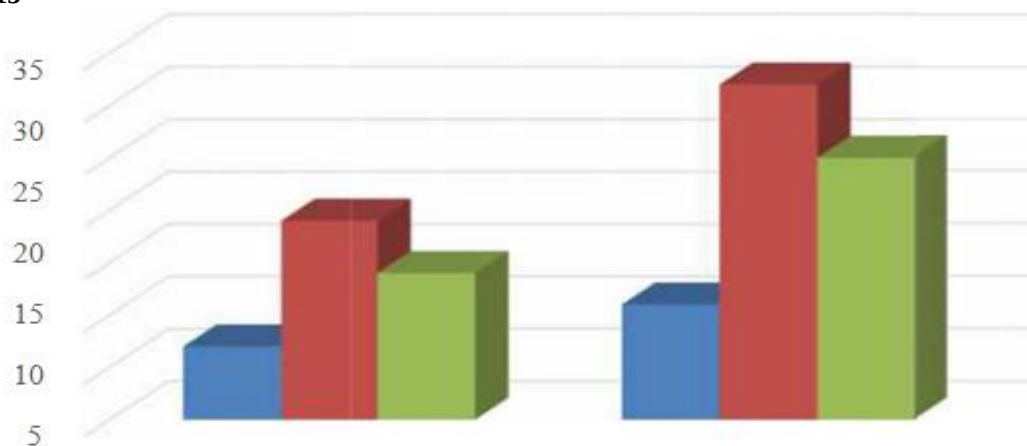
EXHIBIT 12

Distribution of NIMD among gender

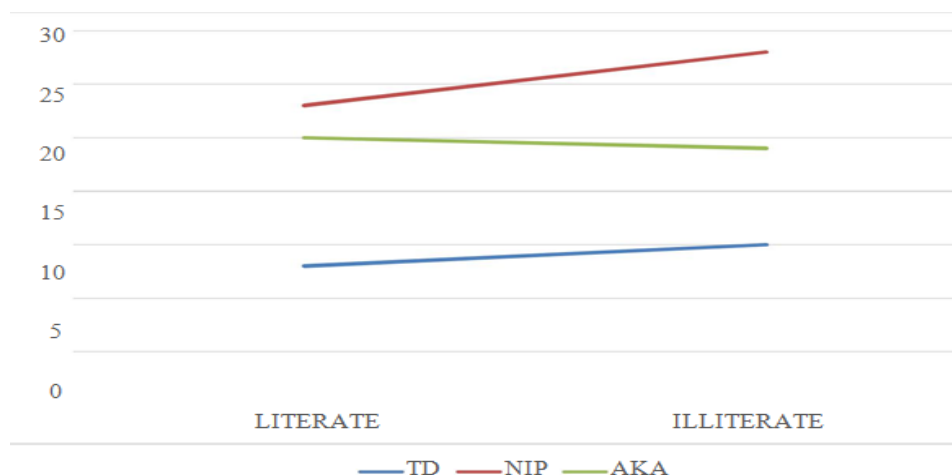


DISTRIBUTION OF NIMD AMONG EMPLOYMENT STATUS OF SUBJECTS

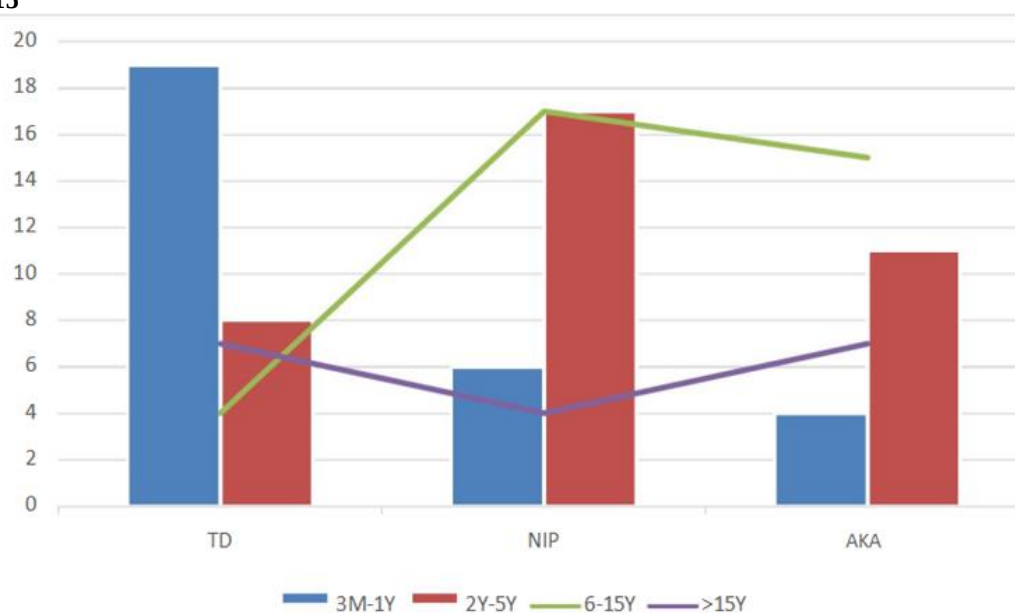
EXHIBIT 13



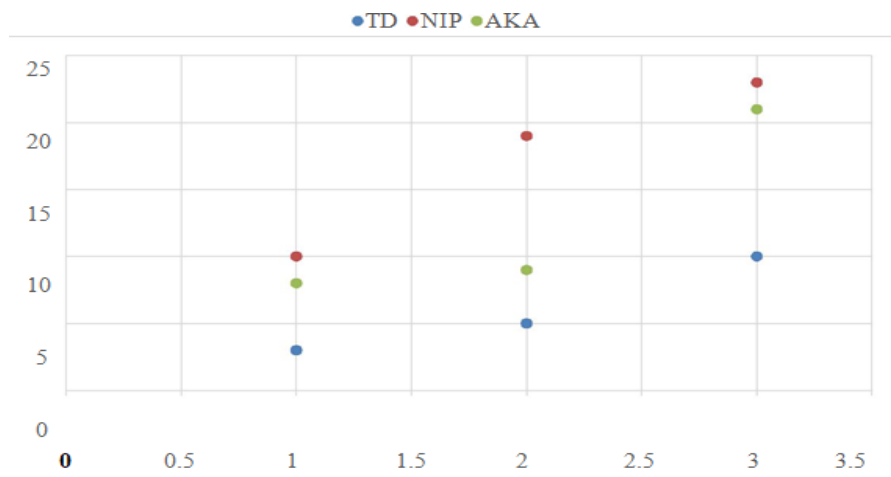
DISTRIBUTION OF NIMD AMONG EDUCATIONAL STATUS EXHIBIT 14



COMPARISON OF ASSOCIATION BETWEEN DURATION OF TREATMENT AND NIMD EXHIBIT 15



ASSOCIATION BETWEEN NIMD AND NUMBER OF ANTIPSYCHOTICS (POLYTHERAPY) EXHIBIT 16



DISCUSSION

The first aim of this study was to determine the presence of extrapyramidal adverse events in psychiatric patients who were on antipsychotics.

Out of 580 subjects who completed the study, 64(11.03%) suffered from NIMD. The data obtained from a study conducted at tertiary care neurosciences teaching hospital in Kolkata, by Ananya Mandal et al., 2010.^[20] showed that the incidence of drug induced movement disorders was 10.15% i.e., out of 786 subjects, 78 patients were found with NIMD. Similarly in a study conducted by J Avorn et al.,^[34] out of 251 patients, the incidence of NIMD was 127 which was 50%. In our study, approximately 89% of subjects did not develop NIMD in spite of being on antipsychotic treatment that indicates even if we prolong the treatment, they don't necessarily have to develop NIMD which are similar to the findings of Avorn et al., 1994.^[34] Novick et al., 2010.^[3] and Karol Woźniak, Iwona Kłoszewska et al., 2016.^[1] that showed 75-80% of the sample that didn't show any NIMD.

In our study out of all subjects who developed NIMD, the most common NIMD was NIP with 80% followed by 61% of akathisia and the least NIMD found was TD with 28%. Data from available research indicate that prevalence of various types of NIMD in subjects treated with antipsychotic drugs may vary, depending on diagnostic criteria, dose and type of drugs and sociodemographic and clinical characteristics of patients. For example, akathisia has been considered the most frequent NIMD, affecting 25–75% of the antipsychotic treated population (45000 prescriptions), in a study done by Miller et al., 1997.^[35] Yet, van Harten et al., 1997.^[36] of sample size 194 reported that the most frequent antipsychotic-related side effects were tardive dyskinesia (40%) and Parkinsonism (35%). In a study conducted by J Avorn et al.,^[34] the commonest type of DIMD are akathisia (25%), and parkinsonism (50%). In another study conducted at nursing home residents Poland, by Karol Woźniak, Iwona Kłoszewska et al., 2016.^[1] 91 NIMD patients out of 261, the most commonly recorded side effects following antipsychotic treatment were dyskinesia (67%) and dystonia (64.75%). Less common symptoms included Parkinsonism (22.99%) and akathisia (24.52%). Discrepancies between incidences of these studies were probably due to variability in research methodology.

In our study, out of all the subjects who developed NIMD, the severity of akathisia was mild in 2.9% individuals, moderate in 3.1% individuals, severe in 0.6% individuals, the severity of TD was mild in 0.8% individuals, moderate in 1.8% individuals, severe in 0.3%, the severity of NIP was mild in 8.7% and moderate in 4.4% individuals. In our study, there was very less severe NIMD noted. Similar to our results, a study conducted by the Ayehu et al.^[37] the severity of the extrapyramidal symptoms was moderate in the 45%

individuals, mild in the 25.71% individuals and severe in the 10% individuals.

Moreover, our study demonstrated that one psychiatric patient may exhibit a combination of different NIMD, while the most common combination includes various forms of hyperkinetic or hypokinetic movement disorders. Our study demonstrated 11% of the sample have at least one NIMD. There was an overlap of 34% between TD and NIP whereas, 47% of overlap was seen in between akathisia and NIP and 13% of overlap between akathisia and TD and amongst the 3, the overlap was found to be 13%. And out of 64 NIMD patients, the patients with only NIP were 19%, the patients with only TD were 5% and the patients with only akathisia were 14%. And the patients without any one of the NIMD were 88.9%.

Similarly, in a study conducted by Sven Janno et al., Estonia^[30], 61% of the sample had at least one NIMD, and it also showed that 12.1% of the sample had akathisia and TD, 6.1% of sample had TD and NIP, 10.1% of the sample had NIP and akathisia. Likewise, in a study conducted by P. Roberto Bakker et al.,^[12] 68% of the participants had at least one type of persistent movement disorder, and 24.7% had at least 2 types of persistent movement disorders.

In our study, we also investigated the association between certain socio-demographic, clinical factors and antipsychotic induced NIMD such as gender, age, polytherapy, duration of treatment, substance abuse and other sociodemographic characteristics like educational status, marital status, and occupation.

Out of all sociodemographic characteristics, we only got statistically significant association for education and employment with development of NIMD, similar to the study of Habtamu Taye, Ethiopia et al.,^[6] that showed that NIMD had statistically significant association with employment. However the same study states that there was no association between NIMD and education which is contrary to our result.

In our study, majority of the patients with psychotic problems were male with 51.3% followed by female with 48.6% and among the female sample, 2.2% subjects had TD, 3.1% had NIP, 3.2% had akathisia and in male subjects, the most common NIMD was found to be NIP with 6%, followed by akathisia with 4.4% and less common include TD with 2.2%. However these findings did not show any statistically significant association with DIMD which is similar to the findings of Karol Woźniak, Iwona Kłoszewska et al., 2016^[1], Habtamu Taye, Ethiopia et al.,^[6] Leonardo Cortese et al.,^[16] Sven Janno et al., Estonia^[30], J Avorn et al.,^[34] However, a study done by Rebekka

A Lencer et al., 2004^[38] got significant association between gender and NIMD. In our study, the incidence

of NIMD is higher in 21-40 year age group with 6.2% followed by 41-60 age groups with 3.9% followed by ≥ 60 age group with 0.5% and 18-20 age group with 0.3%. However these findings did not show any statistical significance, hence age has no correlation with NIMD. Our findings are in line with the study of Habtamu Taye, Ethiopia et al.,^[6] J Avorn et al.^[34] However, in a study conducted at Poland by Karol Wozniak, Iwona Kłoszewska et al., 2016^[1] P. Roberto Bakker et al.^[12] Leonardo cortese et al.^[16] Rebekka A Lencer et al., 2004^[38] the differences between age groups and NIMD were statistically significant which is contrary to our study.

Similarly, in our study the findings of marital status were not statistically significant with DIMD. Similar findings were seen in the studies of Karol Wozniak, Iwona Kłoszewska et al., 2016.^[1] Sven Janno et al., Estonia.^[30] Contrary to our study, there is a study of Habtamu Taye, Ethiopia et al.^[6] that got statistical significance between unmarried and NIP.

We considered clinical parameters such as substance abuse (alcohol and smoking), polytherapy, duration of treatment, but for except latter, none of these had any statistical significance to movement disorders. Similar to our findings, Karol Wozniak, Iwona Kłoszewska et al., 2016^[1], Sven Janno et al., Estonia.^[30] studies also didn't get association between NIMD and substance abuse. However, in Habtamu Taye, Ethiopia et al.,^[6] studies, results got significant relationship between substance abuse and TD and akathisia and between NIP and smoking. In our study, we didn't get significance for polytherapy, however in Karol Wozniak, Iwona Kłoszewska et al., 2016.^[1] study, they got significance for polytherapy. Duration of treatment for which we got statistical significance with NIMD reveals that there were more MD seen in patients on antipsychotics for 3m-1yr. Similarly, some studies i.e., Habtamu Taye, Ethiopia et al.^[6] (results showed that there were more NIP, TD in patients on treatment for 6m-5y), Leonardo cortese et al.^[16] Amresh Srivastava et al.,^[21] Rebekka A Lencer et al., 2004, had also found significance with substance abuse and NIMD. But these findings are different from the results of Sven Janno et al., Estonia.^[30] for which they didn't get significance.

The discrepancies between results obtained in these studies may result from different research methodology or differences in population characteristics, e.g. ethnic origin. Individual patients may show a wide variability in site and severity of involuntary movements, related to adjustment of medication, anxiety, posture and mobility.

CONCLUSION

- In conclusion, many patients with psychotic disorders suffered from antipsychotic - induced movement disorders which were seen as burdening and stigmatizing phenomena.
- NIMD was seen in 11.03% of our subjects.

- Among the NIMD observed in the sample, the most common was found to be NIP followed by Akathisia and TD.
- The results of our study show that there is no significant association between NIMD and age, gender, marital status, alcohol abuse and nicotine abuse, and polytherapy.
- It was seen that illiterates and unemployed subjects had more incidence of NIMD.
- It was also observed that those who had a duration of 3 months to 1 year of treatment had more incidence of TD.
- NIMD has a great influence on the compliance of the patients towards the antipsychotic medications leading to failure of the treatment. It is hence essential that clinicians regularly evaluate patients for these conditions to prevent their emergence and progression.
- Designing treatment guidelines, increasing availability of drugs with minimal side effects and psycho-education on associated factors (e.g. tobacco use, alcohol consumption) is essential.
- Clinicians should remain mindful for the possible development of NIMD when choosing an antipsychotic, and to ensure that patients are systematically monitored, preferably with the use of one of the recognised rating scales developed for this purpose. Thus, the recognition of these side effects and their management can lead to strategies which ensure compliance to treatment eventually leading to remission.

REFERENCES

1. Karol Wozniak, Iwona Kłoszewska; "Clinical assessment of antipsychotic induced extra pyramidal symptoms in nursing home residents with schizophrenia"; Journal of Psychiatry and Clinical Psychology. 2016; 16(1): pg:7-
2. Kirgaval RS, Revanakar S, Srirangapattana C (2017); "Prevalence of extrapyramidal side effects in patients on antipsychotics drugs at a tertiary care centre" Journal of Psychiatry. 20: 419. doi:10.4172/2378-5756.1000419
3. Novick Diego, Haro, Josep Maria; "Incidence of extra pyramidal symptoms and tardive dyskinesia in schizophrenia: 36 month results from European schizophrenia outpatient health outcomes study"; Journal of Clinical Psychopharmacology. October 2010; 30(5): 31-540.
4. H. Heck, P.M.J. Haffmans, I. W. de Groot; "Risperidone vs haloperidol in psychotic patients with disturbing neuroleptic induced extrapyramidal symptoms"; The Official Journal of the Schizophrenia International Research Society. December 15; 2000; (46): 2(3): 97-105.
5. Swamy MK, Wagle L and Giri V; "Drug utilisation pattern of psychotropic drugs in psychiatric outpatient department of rural tertiary care teaching hospital"; International Journal of Pharmaceutical Sciences and Research, 2016; 7(8): 3497-08. doi:

- 10.13040/IJPSR.0975-8232.7(8):3497-08.
6. Habtamu Taye, Tadesse Awoke, Jemal Ebrahim; "Antipsychotic medication induced movement disorders: the case of Amanuel specialised mental hospital, Ethiopia"; *American Journal of Psychiatry and Neuroscience*. Volume 2, no.5, 2014 pp 76-82. Maju Mathews, Sylvia, Gratz, Biju Basil; "Antipsychotic induced movement disorders"; *Psychiatry (Edmont)*, 2005 march; 2(3): 36-41.
7. Avasthi. A, Agarwal. M, Grover. S, Khan. MR; "Research on antipsychotics in India"; *Indian Journal of Psychiatry*. January 2010; 52, suppl S3:317-40 Dhavale HS, Pinto C, Dass J, Nayak A, Kedare J, Kamat M, Dwan M; "Prophylaxis of antipsychotic induced eps in east Indians; cultural practice and biological necessity"; *Journal of Psychiatric practice*, May (2004); 10(3): 200-2.
8. Allah Buksh, Zulfiqar Ali, Muhammad Tayyab, Zubda Gohar ; "Comparative evaluation of side effects of typical and atypical antipsychotics in psychotic patients at Punjab institute of mental health, Lahore, Pakistan"; *Advances in Pharmaceutical and Ethnomedicines*, 2(1): 14-17.
9. Stanley N. caroff, Irene Hurford, Janice Lybrand, E. Cabrina Campell; "Movement disorders induced by antipsychotics implication of CATIE schizophrenia trials"; *Neurologic clinics*. February, 2011; 29(1): 127-8.
10. P. Roberto bakkaer, Asmar F. Y. Al hadithy, Najaf amin, Cornelia M. Van duijn, Jim Van, Os. Peter N, Van Harten; "Antipsychotic induced movement disorders in long stay psychiatric patients"; *Plos one*. October 29 2012; 7(12): e50970.
11. Thomson SR, Chogtu B, Bhattacharjee D, Agarwal S; "Extrapyramidal symptoms probably related to Risperidone treatment: a case series"; *Annals of Neurosciences*, 2017; 24(3): 155-163. doi:10.1159/000477153.
12. Miller CH1, Mohr F, Umbricht D, Woerner M, Fleischhacker WW, Lieberman JA; "The prevalence of acute extrapyramidal signs and symptoms in patients treated with clozapine, risperidone, and conventional antipsychotics;" *Journal of Clinical Psychiatry*, 1998 February; 59(2): 69-75.
13. Jian-Ping, Juan A. Gallego, Delbert G. Robinson, Anil K. Malhotra, John M. Kane and Christoph U. Correll; "Efficacy and safety of individual second generation vs first generation antipsychotics in first episode psychosis"; *International Journal of Neuro psychopharmacology*, 2013; 16: 1205-1218. 10(2017).
14. Leonardo cortese, Mandar jog, T Jeffrey, Kottedda, Giuseppe Costa; "Assessing and monitoring antipsychotic induced movement disorders in hospitalizedpatients"; *Canadian Journal of psychiatry*, 2004; 49(1): 31-36.
15. Garhard Grunder, martin Heinze chim Corde, bernd muhlbauer, georg juckel, constanze schulz et.al; "Effect of first generation antipsychotics versus second generation antipsychotics on quality of life in schizophrenia"; *International psychology*, June 2016; 3(8): 717-729.
16. M. G. Scordo, E. Spina, P. Romeo, I. Johansson "Antipsychotic induced extra pyramidal side effects in schizophrenic patients"; *European Journal of Clinical Pharmacology*, 2000; (56): 679-683.
17. P. N. Suresh kumar, T. Manojkumar; "A comparative study of neuroleptic induced neurological side effects in schizophrenia and mood disorders"; *Indian Journal of Psychiatry*, 1997; 39(2): 110-114.
18. Ananya Mandal, Suparna Chatarjee, Shyamal kumar, Amar Mishra ; "Drug safety monitoring in patients of movement disorders of a tertiary care hospital"; *Indian Journal of Pharmacology*, August 2010; 42(4): 249-251.
19. Amresh Srivastava, Megan Johnston , Kristen Terpstra, Larry Stitt, Avinash De Sousa, Nilesh Shah; "Extrapyramidal symptoms in 10 years of long term treatment of schizophrenia: independent of psychopathology and outcome"; *Scholars Journal of Applied Medical Sciences*, 2013; 1(6): 1000-1004.
20. Thomas Mathew, Uday S Nadimpally, Aravind D Prabhu, Raghunandan nadig: " drug induced Parkinsonism on the rise: be aware of levosulpiride and its combinations with proton pump inhibitors"; *Neurological society of India*. 2017; volume: 65. 173-174.76.Asha K Patel, Jayant Bdev, Dharmesh Patel; "Assessment of extrapyramidal symptoms with antipsychotics in schizophrenia patients"; *Integrated Biomedical Sciences*, 2015; (1): 27-33..
21. Georges M. Gharabawia, Cynthia A. Bossiea, Robert A. Lasser, albrahim TurkozaStephen Rodriguez, aGuyChouinardb ; "Abnormal involuntary movement scale(aims) and extrapyramidal symptom rating scale (esrs): cross-scale comparison in assessing tardive dyskinesia"; *Science Direct*, Volume 77, Issues 2-3, 15 September 2005; Pages 119-128.
22. Atmaca M, Korkmaz S; "Delayed onset akathisia due to Amisulpiride"; *Indian Journal of Pharmacology*, 2011; 43: 460-462.
23. Sven Janno, Matti M. Holli, Katinka Tuisku, Kristian Wahlbeck ; "Actometry and Barnes Akathisia Rating Scale in neuroleptic induced akathisia"; *European Neuro psychopharmacology*, 15; January 2005; 39-41.
24. Thomas. R. E. Barnes; "A rating scale for drug induced akathisia" *British Journal of Psychiatry*, 1989; 154; 672-676.
25. Knoll W, Keijsers CJ, Jansen PA, Belitsar SV, Van marum RJ; "Validity and reliability of the simpson angus scale in drug induced parkinsonism in the elderly"; *International Journal of Geriatric Psychiatry*, 2009 February; 24(2): 183-189.
26. Sven Janno, Matti M Holli, Katinka Tuisku, Kristian Wahlbeck: "Validity of simpson-angus scale (SAS) in a naturalistic schizophrenia population"; *BMC Neurology*, 2005; 5: 5 17 March 2005; ISSN: 1471-

2377.

27. Sven Janno, Matti M Holi, Katinka Tuisku, Kristian Wahlbeck; "Prevalence of neuroleptic induced movement disorders in chronic schizophrenia inpatients"; American Journal of Psychiatry, 2004; 161; 160-163.
28. Barnes TR: "A Rating scale for Drug-Induced Akathisia"; British journal of psychiatry, 1989; 154: 672-676.
29. Simpson GM, Angus JWS: "A Rating scale for extrapyramidal side effects"; acta psychiatrica scandinavica, 212; 11-19.
30. Rush JA Jr, Hand book of Psychiatric measures; "Abnormal involuntary movement scale"; American psychiatric association, 2000; 166-168.
31. Avorn J, Monane M, Everitt DE et al; "Clinical assessment of extrapyramidal signs in nursing home patients given antipsychotic medication; Archives of Internal Medicine, 1994; 154: 1113-111.
32. Miller CH, Hummer M, Oberbauer H et al; "Risk factors for the development of neuroleptic induced akathisia"; European Neuro psycho pharmacology, 1997; 7: 51-55.
33. Van Harten PN, Hoek HW, Matroos GE et al; "The inter-relationships of tardive dyskinesia, parkinsonism, akathisia and tardive dystonia: the Curaçao Extrapyramidal Syndromes Study II"; Schizophrenia Research. 1997; 26: 235-242.
34. Moges Ayehu, Teshome Shibre, Barkot milkias, Abebaw Fekadu et al; "Movement disorders in neuroleptic naïve patients with schizophrenia spectrum disorders"; BMC Psychiatry, October 2014; 14(1): 280.
35. Rebekka A Lencer, Gunnar Eismann et al; "Family history of primary movement disorders as a predictor for neuroleptic induced extrapyramidal symptoms"; British journal of psychiatry, 2004; 185: 465-471.