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Original Research Article

A Cross-Sectional Study of Neurological Soft Signs with Sociodemographic and Clinical Profile in Psychiatric Disorders

Suman[1], Alok Tyagi[2], Harshpreet Kour[3], Gaurav Rajender[4]

[1]Junior Resident, Department Of Psychiatry, S.M.S Medical College, Jaipur, Rajasthan, India
[2]Senior Professor, Unit Head and Head of Department, Department of Psychiatry, S.M.S Medical College, Jaipur, Rajasthan, India
[3]Junior Resident, Department Of Psychiatry, S.M.S Medical College, Jaipur, Rajasthan, India
[4]Professor, Department of Psychiatry, S.M.S Medical College, Jaipur, Rajasthan, India

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Corresponding Author: Dr. Suman
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Abstract:

Background: Neurological soft signs (NSS) are non-localizing neurological abnormalities indicative of subtle cortical-subcortical dysfunction, commonly seen in psychiatric conditions. Though extensively studied in psychotic disorders like schizophrenia, NSS are increasingly recognized in non-psychotic psychiatric conditions as well.

Objectives: This study aimed to compare the severity of NSS in psychiatric patients with and without psychotic symptoms, and to explore associated sociodemographic and clinical variables.

Methods: A cross-sectional, comparative observational study was conducted among 100 drug-naïve psychiatric patients aged 18–60 years, equally divided into psychotic and non-psychotic groups. Patients were assessed using the MINI-PLUS for diagnostic confirmation and the Neurological Evaluation Scale (NES) for NSS. Additional scales including BPRS, PANSS, HAM-A, MADRS, and Y-BOCS were used to measure symptom severity.

Results: The mean NES score was significantly higher in patients with psychotic symptoms (17.70 ± 7.53) compared to those without (6.96 ± 4.41), $p < 0.001$. Prominent NSS domains in psychotic patients included motor coordination and complex motor sequencing. While NSS were also present in non-psychotic disorders like OCD and anxiety, their severity was markedly lower.

Conclusion: NSS are significantly more prevalent in psychiatric disorders with psychotic features, supporting their role as potential neurodevelopmental markers. Their presence, even in non-psychotic conditions, suggests a spectrum of neurological involvement in psychiatric illness. NSS assessment may aid in early diagnosis, clinical differentiation, and intervention planning.

Keywords: Neurological soft signs, psychosis, schizophrenia, psychiatric disorders, Neurodevelopment, NES, anxiety, OCD.

Introduction

Neurological soft signs (NSS) are quite common in children having psychiatric disorders [1].Evaluation for NSS may be useful for identification of certain psychiatric disorders (e.g. hyperkinetic disorder, learning disorder). They may also help in assessment of prognosis and monitoring the response to treatment.[2,3]. Lerer et al [4] demonstrated some improvement in NSS after 60 days of treatment with methylphenidate in hyperactive children.

These soft signs are objectively determined, non-localizing abnormalities which exhibit faulty cortico-subcortical and intercortical connections without being linked to damage of a specific brain region. The word "soft" refers to the absence of any other symptoms that might indicate a permanent or transient neurological lesion or condition in the person exhibiting the sign. Many scales have been devised to study brain dysfunction in schizophrenia, including the Heidelberger Scale, the Cambridge Neurological Inventory, and the Neurological Evaluation Scale (NES)[5].

Patients with labile mood and those with history of social difficulties as children are more frequently have neurological soft signs. In nonclinical pediatric populations, NSS is more prevalent in boys and is linked to social immaturity, lack of motivation and cooperation, and low achievement in reading. NSS in psychiatric disorders usually reflects developmental issues arising from both

non-genetic and genetic causes. It has been suggested that elevated NSS, along with other findings such moderate physical abnormalities, premorbid cognitive impairments, and obstetric issues, supports the neuro-developmental theory of schizophrenia and other psychiatric disorders. However, NSS should not be considered as entirely static as NSS can vary during the course of psychiatric disorders [6] . Birch et al[7] considered the presence of 2 or more soft signs as evidence of CNS dysfunction.

Neurological soft signs in other psychiatric disorders, for example, anxiety disorders, are characterized by excessive worry, fear, and autonomic hyperactivity. Panic disorder, a subset of anxiety disorders, manifests as recurrent episodes of intense fear, accompanied by physiological symptoms such as palpitations, dizziness, and a sense of impending doom. Brief psychotic disorder is marked by a sudden onset of delusions, hallucinations, and disorganized thought processes, often with a brief duration and rapid remission[8] . Panic disorder is a subset of anxiety disorders, marked by recurrent episodes of sudden, intense fear accompanied by physical symptoms such as palpitations and breathlessness. Studies indicate that NSS are more prevalent in psychotic disorders; however, they have also been identified in anxiety-related conditions, including social phobia and post-traumatic stress disorder (PTSD)[9].

Comparing NSS in psychiatric disorders with and without psychotic symptoms may help delineate shared and distinct neurobiological mechanisms, offering insights into early diagnosis and intervention strategies.

This study aims to compare NSS across psychiatric disorders with and without psychotic symptoms, helping to identify shared and distinct neurobiological mechanisms. Such findings could contribute to early diagnosis and intervention strategies, improving clinical outcomes in psychiatric disorders.

Review of literature: Venkatasubramanian et al.[10] used the modified Neurological Evaluation Scale with strong inter-rater reliability to examine NSS in people with untreated schizophrenia whose age, sex, education, and handedness matched those of normal controls. According to their research, people with schizophrenia had noticeably higher NSS than people without the disorder. There was no discernible relationship between NSS and the length of illness. Increased neurological symptoms in individuals who have never received treatment and their lack of correlation with the length of disease point to a neurodevelopmental etiopathogenesis for schizophrenia.

Guz and Aygun[11] looked at the connection between obsessive-compulsive disorder (OCD) and NSSs. This study included 30 consecutive patients who presented with DSM IV OCD. Thirty healthy individuals without any neurological or mental conditions made up the control group. A neurological and physical examination for soft signs (PANESS) was performed on each patient. The OCD group's two-point discrimination, graphesthesia, and overall PANESS ratings were found to be significantly higher than those of the control group. The patient and control groups did not significantly vary in other NSSs. In contrast to prior investigations, the current study found a significant difference between the groups in graphesthesia and other NSSs. The findings of this exploratory investigation point to a connection between OCD and NSSs.

Negash et al., examined the extent to which NSS are associated with bipolar I disorder cases compared to healthy controls, to assess the possible relationship between NSS and clinical dimensions of the disorder, and to explore the association of sociodemographic characteristics with the occurrence of NSS in cases with this disorder. The Neurological Evaluation Scale (NES) was used to evaluate treatments-naïve cases of bipolar I illness from rural populations for NSS. Bipolar I disorder patients significantly performed worse on four items from the others subscale, one item from motor coordination, and two NES items from the sensory integration subscale, with the sequencing of complex motor acts subscale showing the largest performance difference. The NES total score did not see to be correlated with clinical dimensions or sociodemographic features.

Materials and Methods

Study Design and Setting: This cross-sectional, comparative observational study was conducted in the Department of Psychiatry at S.M.S. Medical College, Jaipur. The study was carried out on patients diagnosed with psychiatric disorders, with or without psychotic symptoms, over the designated study period.

Sample and Sampling Technique

A total of 100 participants were enrolled, divided into two equal groups:

- Group 1: 50 patients with psychotic symptoms.
- Group 2: 50 patients without psychotic symptoms.

Participants were selected using convenience sampling, matched for age and gender distribution.

Inclusion Criteria

- Age between 18–60 years.
- Drug-naïve patients (no psychotropic medication use in the last 6 months).
- Diagnosed with psychiatric disorders (DSM-5 TR criteria) including:

- With psychotic symptoms: Schizophrenia, schizoaffective disorder, psychotic depression, psychosis NOS, BPAD with psychotic features.
- Without psychotic symptoms: Depression, OCD, anxiety disorders, dissociative and somatoform disorders.

Exclusion Criteria

- Organic mental disorders.
- Substance dependence (except nicotine).
- Intellectual developmental disorder.
- Speech or hearing impairment.

Assessment Tools

1. MINI-PLUS: Diagnostic tool to categorize psychotic vs. non-psychotic patients.
2. Neurological Evaluation Scale (NES): 26-item scale scoring from 0 (absent) to 2 (extreme).
3. Brief Psychiatric Rating Scale (BPRS), PANSS, HAM-A, MADRS, Y-BOCS: Used to assess symptom severity.

Data Collection Procedure: Patients meeting inclusion criteria were administered:

- A socio-demographic and clinical profile proforma.
- Psychiatric rating scales (BPRS, PANSS, HAM-A, YBOCS, MADRS).
- Neurological Soft Signs were recorded using NES.

Ethical Considerations

- Approved by Institutional Ethics Committee.
- Informed written consent obtained.
- Confidentiality and voluntary participation assured.

Statistical Analysis: Data were analyzed using SPSS version 20.0. Descriptive statistics were expressed as mean ± SD. Group comparisons were done using Chi-square and t-tests. Significance level was set at $p < 0.05$.

Results

Out of 100 patients, the mean age was 35.24 ± 10.13 years. The ages ranged from a minimum of 18 years to a maximum of 59 years. The gender distribution was nearly equal (49% males and 51% females). The majority were married (69%) and from urban areas (53%).

Table 1: Demographic Profile of the Participants

Variable	Category	Frequency (n)	Percentage (%)
Age Group	18–30	40	40%
	31–40	30	30%
	41–50	23	23%
	51–60	7	7%
Gender	Male	49	49%
	Female	51	51%
Marital Status	Married	69	69%
	Unmarried/Separated/Divorced	31	31%
Locality	Urban	53	53%
	Rural	47	47%

Most patients had illness onset between 18–25 years (37%). The average illness duration was under 5 years in 62% of participants.

Table 2: Clinical Variables

Variable	Category	Frequency (n)	Percentage (%)
Age of Onset	18–25 years	37	37%
	>35 years	24	24%
Duration of Illness	≤5 years	62	62%
	>10 years	19	19%

The mean NES total score was significantly higher in patients with psychotic symptoms (17.70 ± 7.53) than in those without psychotic symptoms (6.96 ± 4.41) ($p < 0.001$).

Table 3: NES Total Score Comparison between Groups

Group	NES Mean Score ± SD
With Psychotic Symptoms (n=50)	17.70 ± 7.53
Without Psychotic Symptoms	6.96 ± 4.41

Motor coordination and complex motor sequencing deficits were prominent among psychotic patients. Reflexes such as the glabellar were also commonly abnormal. Among the psychotic group:

Schizophrenia (15%), other psychotic disorders (14%), and depression with psychotic features (9%) were most common.

Among non-psychotic group: Depression (15%), OCD (12%), and anxiety disorders (10%) were predominant.

Table 4: Distribution of Psychiatric Diagnoses

Diagnosis	Frequency (n)	Percentage (%)
Schizophrenia	15	15%
Depression with Psychotic Features	9	9%
Other Psychotic Disorders	14	14%
Depression (non-psychotic)	15	15%
OCD	12	12%
Anxiety Disorders	10	10%

Participants with psychotic symptoms had a mean NES score of 17.70 with a standard deviation of 7.53, whereas those without psychotic symptoms had a substantially lower mean score of 6.96 with a standard deviation of 4.41. The NES score difference between the two groups was statistically significant, according to the Chi-square test result, which had a value of 52.6200 and a p-value of 0.0022.

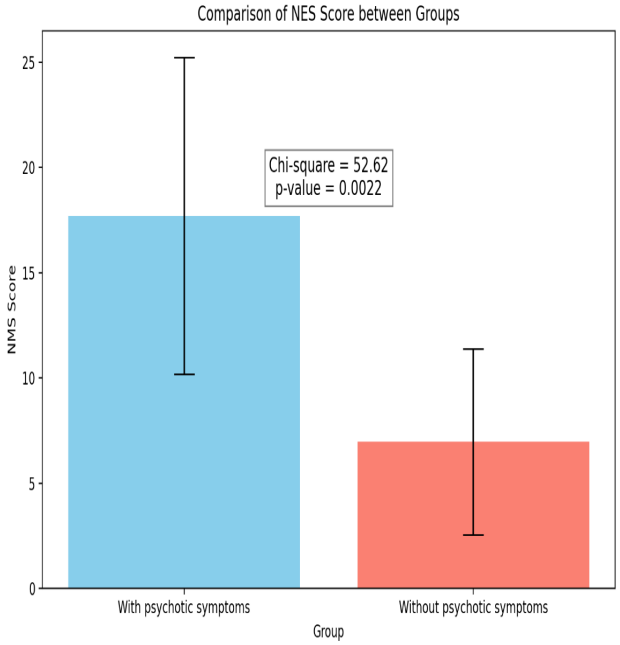

Figure 1: NES Score Distribution in Psychotic vs. Non-Psychotic Patients

In Table 5, neurological soft signs (NSS) are mentioned using the Neurological Evaluation Scale (NES), which categorizes NSS into functional domains that reflect different aspects of neurodevelopment and brain function. These areas include primordial reflexes and disinhibition, motor coordination, sensory integration, and the sequencing of complicated motor acts. Cortical and parietal lobe functions are reflected in the sensory integration domain, which includes symptoms like audiovisual (A-V) integration, stereognosis, graphesthesia, extinction, and right-left confusion.

Table 5: Subscales of Neurological Soft Signs (Based on NES - Neurological Evaluation Scale)

Subscale/Domain	Component NSS Items
Sensory Integration	A-V Integration, Stereognosis, Graphesthesia, Extinction, R/L Confusion
Motor Coordination	Tandem Walk, Rapid Alternating Movements, Finger-thumb Opposition, Finger-nose Test
Sequencing of Complex Motor Acts	Fist-Ring Test, Fist-Edge-Palm Test, Ozeretski Test, Rhythm Tapping Test
Others (Primitive Reflexes, Inhibition)	Adventitious Flow, Romberg, Tremors, Memory, Mirror Movements, Synkinesis, Convergence, Gaze Impersistence, Glabellar Reflex, Snout Reflex, Suck Reflex

Table 6 shows that patients with psychotic symptoms scored significantly higher in several Neurological Soft Sign (NSS) subdomains compared to those without psychotic symptoms. These include audiovisual integration, graphesthesia, extinction, motor coordination (e.g., tandem walk, finger–thumb opposition), and reflex abnormalities.

This suggests a greater degree of neurodevelopmental dysfunction in the psychotic group.

Table 6: Comparison of NES Sub-scores between Groups

NES Subdomain	Psychotic Symptoms (Mean ± SD)	Non-Psychotic Symptoms (Mean ± SD)	p-value
Audiovisual Integration	1.04 ± 0.669	0.46 ± 0.579	0.001
Stereognosis	0.58 ± 0.642	0.12 ± 0.328	0.001
Graphesthesia	1.52 ± 0.614	0.62 ± 0.667	0.001
Extinction	0.82 ± 0.800	0.24 ± 0.476	0.001
Right/Left Confusion	1.30 ± 0.735	0.46 ± 0.579	0.001
Tandem Walk	0.24 ± 0.431	0.00 ± 0.00	0.001
Rapid Alternating Movements	0.82 ± 0.800	0.40 ± 0.535	0.004
Finger–Thumb Opposition	0.48 ± 0.707	0.12 ± 0.328	0.007
Fist–Ring Test	1.62 ± 0.490	0.92 ± 0.528	0.001
Fist–Edge–Palm Test	1.74 ± 0.443	0.96 ± 0.570	0.001
Memory	1.22 ± 0.764	0.66 ± 0.593	0.001
Glabellar Reflex	1.36 ± 0.631	0.62 ± 0.602	0.001
Gaze Impersistence	1.14 ± 0.729	0.34 ± 0.557	0.001
Other domains	Mostly higher in the psychotic group	Lower	NS or zero

Table 7 indicates that patients with psychotic symptoms had significantly higher scores on PANSS and BPRS, reflecting more severe psychopathology. In contrast, non-psychotic patients showed higher levels of anxiety (HAM-A) and obsessive-compulsive symptoms (YBOCS). Depression severity (MADRS) was similar in both groups, with no significant difference.

Table 7: Comparison of PANSS, BPRS, YBOCS, MADRAS, HAM-A severity between groups

scores	Psychotic symptoms	Mean	Std. Deviation	Independent T test	P value
PANSS	With psychotic symptoms	1.82	0.748	6.845	**0.000***
	Without psychotic symptoms	1.06	0.240		
BPRS	With psychotic symptoms	2.08	0.804	8.881	**0.000***
	Without psychotic symptoms	1.04	0.198		
YBOCS	With psychotic symptoms	1.14	0.495	2.645	**0.000***
	Without psychotic symptoms	1.64	1.241		
HAM-A	With psychotic symptoms	1.32	0.513	1.887	**0.000***
	Without psychotic symptoms	1.54	0.646		
MADRS	With psychotic symptoms	1.98	0.937	1.357	0.727
	Without psychotic symptoms	1.74	0.828		

Discussion

This cross-sectional observational study examined and compared the prevalence and characteristics of Neurological Soft Signs (NSS) among patients with psychiatric disorders with and without psychotic symptoms. The key finding was that the mean total NES (Neurological Evaluation Scale) score was significantly higher in patients with psychotic symptoms (17.70 ± 7.53) compared to those without psychotic symptoms (6.96 ± 4.41), with statistical significance ($p < 0.001$). This supports the hypothesis that NSS are more prevalent and pronounced in psychotic spectrum disorders. These findings are consistent with those of Venkatasubramanian et al. (2003), who also reported significantly elevated NSS in never-treated schizophrenia patients, suggesting a neurodevelopmental basis of psychosis that is relatively independent of illness duration.

The current study similarly found no significant relationship between illness duration and NSS scores, indicating that NSS may represent trait markers rather than state-dependent phenomena. According to Mittal et al, [12] a relationship between the pathophysiology of schizophrenia and NSS has been suggested by various lines of research. NSS was present in almost 60% of schizophrenia patients at baseline [13]. Higher

levels of NSS have been seen in first-episode patients compared to controls [14], as well as both medicated and treatment-naive individuals with schizophrenia.

Likewise, Negash et al. observed that patients with bipolar I disorder exhibited significantly more soft signs compared to healthy controls, particularly in domains like sensory integration and motor sequencing, aligning with this study's finding of motor coordination and sequencing deficits being particularly elevated in psychotic patients.

While this study emphasized differences between psychotic and non-psychotic disorders, it also contributes to the growing body of evidence that NSS are not exclusive to psychosis. For instance, Guz and Aygun (2004) identified elevated PANESS scores in patients with obsessive-compulsive disorder (OCD), particularly in graphesthesia and two-point discrimination, suggesting that NSS may have relevance across multiple psychiatric conditions.

The findings also resonate with the results of Nasab et al. , who reported a significant difference in NSS between psychotic and non-psychotic patients, emphasizing that intercortical and cortico-subcortical disconnections are more pronounced in psychotic conditions.

Moreover, the observed demographic profile (mean age ~35 years, mostly married, urban distribution) is representative of psychiatric outpatients in India and corresponds with the typical age of onset and illness duration reported in the psychiatric literature.

This study also strengthens the concept, as discussed by Toro & Schröder (2019) that NSS can serve as early biomarkers for identifying individuals at risk for psychotic disorders and may assist in differential diagnosis and early intervention strategies. Patients with psychotic symptoms exhibit significantly more neurological soft signs (NSS), particularly in motor coordination, sensory integration, and sequencing tasks—suggesting underlying neurodevelopmental disruptions. For instance, studies by Tripathi et al.[15] and Devabhaktuni et al.[16] demonstrated higher NSS prevalence and severity among patients with schizophrenia as compared to those with obsessive-compulsive disorder (OCD) or healthy controls, particularly in the domains of motor coordination and sequencing of complex motor acts.

The results confirm that neurological soft signs are more pronounced in psychiatric patients with psychotic symptoms, supporting earlier findings that NSS may serve as markers of neurodevelopmental disruption in psychosis (Venkatasubramanian et al., 2003). Clinical severity scores also aligned with diagnostic categories: psychotic patients had more severe psychotic features (higher PANSS/BPRS), while non-psychotic patients showed more anxiety and OCD-related symptoms (higher HAM-A/YBOCS). These findings are consistent with studies by Tripathi et al. (2015) and Nasab et al. (2017), highlighting the diagnostic and prognostic relevance of NSS and symptom scales across psychiatric conditions.

Conclusion

This study confirms that Neurological Soft Signs (NSS) are significantly more prevalent and severe in psychiatric patients with psychotic symptoms compared to those without. The findings support the hypothesis that NSS may reflect underlying neurodevelopmental disturbances, especially in psychotic disorders like schizophrenia and schizoaffective disorder. While NSS are also present in non-psychotic psychiatric conditions such as OCD and anxiety disorders, their reduced intensity suggests a dimensional rather than categorical presence of neurological abnormalities across psychiatric diagnoses. The incorporation of NSS evaluation in clinical assessments may enhance early identification of psychotic spectrum disorders and inform tailored therapeutic approaches.

Limitations of the study

This single-center, cross-sectional study with a small sample size (n=100) limits generalizability and causal inference. The absence of a healthy control group, lack of inter-rater reliability checks, and unaccounted comorbid substance use or neurological conditions may affect the validity of the NSS findings. Diagnostic heterogeneity in the non-psychotic group, along with uncontrolled confounders like socioeconomic status, medical conditions, and medication use, further restricts interpretation. Longitudinal studies with larger, more diverse samples are needed.

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