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Case Report

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Machine Learning-Enhanced Evaluation of Neuroleptics Efficacy and Management in Schizoaffective Disorder

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Abstract

Background

Neuroleptics or antipsychotic medications are widely used in the treatment of various psychiatric disorders. However, they have been associated with the secondary development of obsessive-compulsive symptoms (OCS) in some patients. This case report examines two patients who developed obsessive-compulsive aspects secondary to neuroleptic treatment, analysed using visual data representations and machine learning.

Objective

To evaluate the development of OCS in patients treated with neuroleptics and to analyse their clinical outcomes using Y-BOCS and CGI-S scores, complemented by machine learning predictions.

Methods

Two patients treated with neuroleptics were assessed for the emergence of OCS using the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) and Clinical Global Impression-Severity (CGI-S). Data were collected before and after the onset of OCS, and visualizations were employed to illustrate symptom progression and treatment effectiveness. Machine learning techniques were applied to predict OCS outcomes.

Results

Both patients developed significant OCS after the initiation of neuroleptic treatment. Their Y-BOCS and CGI-S scores increased, indicating the emergence and severity of OCS. Following treatment adjustments, both patients showed marked improvement in their scores. Machine learning models provided additional insights into the factors influencing OCS development.

Conclusion

These findings highlight the potential for neuroleptics to induce secondary OCS in patients, necessitating careful monitoring and management of these symptoms. Visual data analysis and machine learning provide powerful tools to understand and communicate these clinical changes.

Keywords: Schizoaffective Disorder, Neuroleptics, Psychotic Symptoms, Obsessive-Compulsive Symptoms, Psychiatric Treatment, Machine Learning

1. Introduction

Schizoaffective disorder is a chronic mental health condition that presents with a combination of symptoms typical of both schizophrenia and mood disorders, either depression or bipolar disorder [1-3]. Patients with schizoaffective disorder experience psychotic symptoms such as delusions, hallucinations, and disorganized thinking, along with mood symptoms that include severe depression or manic episodes [4]. The complex nature of this disorder often necessitates a multifaceted treatment approach, which typically includes the use of neuroleptics, also known as antipsychotic medications, to manage the psychotic components of the illness [5,6]. Neuroleptics are crucial in controlling the core psychotic symptoms of schizoaffective disorder [7]. These medications help stabilize thought processes and reduce psychotic symptoms, thus enabling patients to achieve better overall functioning. However, despite their therapeutic benefits, neuroleptics are associated with a range of potential side effects, some of which can be quite severe and impact the patient's quality of life. Among these, the secondary development of obsessive-compulsive symptoms (OCS) has been increasingly recognized as a significant clinical concern [8,9]. Obsessive-compulsive symptoms are characterized by intrusive, unwanted thoughts (obsessions) and repetitive behaviours or mental acts (compulsions) that the individual feels driven to perform [10,11]. These symptoms can be distressing and debilitating, often interfering with daily functioning and quality of life. The onset of OCS as a side effect of neuroleptic treatment complicates the clinical picture, posing additional challenges for the management of schizoaffective disorder [12-14]. The pathophysiology underlying the development of OCS secondary to neuroleptic treatment is not entirely understood, but several mechanisms have been proposed. It is hypothesized that neuroleptics, particularly atypical antipsychotics, may disrupt the balance of neurotransmitters such as dopamine and serotonin, which play critical roles in mood regulation and behavioural control [15-17]. This disruption may predispose certain individuals to develop OCS. Additionally, the interaction between neuroleptics and other neurotransmitter systems, including glutamate and gamma-aminobutyric acid (GABA), might contribute to the emergence of these symptoms [18,19]. Despite the clinical importance of this issue, there is a paucity of comprehensive research on the incidence and management of neuroleptic-induced OCS [20]. Most available data come from case reports and small observational studies, underscoring the need for more extensive research to elucidate the prevalence, risk factors, and optimal management strategies for neuroleptic-induced OCS.

This case report presents two patients diagnosed with schizoaffective disorder who developed significant OCS following neuroleptic treatment. Ms. K, diagnosed with the depressive type of schizoaffective disorder, and Mr. P, diagnosed with the bipolar type, both exhibited notable improvements in their primary psychotic symptoms with neuroleptic therapy. However, Ms. K developed secondary OCS, highlighting the need for vigilance in monitoring side effects. These cases emphasize the importance of adjusting treatment regimens and incorporating selective serotonin reuptake inhibitors (SSRIs) when managing neuroleptic-induced OCS. Through these cases, we aim to shed light on the occurrence of secondary OCS in patients treated with neuroleptics for schizoaffective disorder, emphasizing the necessity for awareness and proactive management among clinicians. The findings also illustrate the potential benefits of combining neuroleptics with SSRIs to mitigate OCS while maintaining control over primary psychotic symptoms. Further research is essential to better understand the mechanisms and develop evidence-based guidelines for managing neuroleptic-induced OCS, ultimately improving patient outcomes and quality of life.

2. Methods

This case series involved two patients diagnosed with schizoaffective disorder to evaluate the efficacy and side effects of neuroleptic treatment. Ms. K, a 38-year-old woman with schizoaffective disorder, depressive type, was initially treated with olanzapine (10 mg/day) and fluoxetine (20 mg/day). Mr. P, a 45-year-old man with schizoaffective disorder, bipolar type, was treated with risperidone (6 mg/day) and valproate (1000 mg/day). Clinical assessments were conducted using the Positive and Negative Syndrome Scale (PANSS) to measure the severity of psychotic symptoms, the Clinical Global Impression-Severity (CGI-S) to assess overall condition severity, and the Global Assessment of Functioning (GAF) to evaluate overall psychological, social, and occupational functioning [21-23]. For Ms. K, the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) was used to assess the severity of obsessive-compulsive symptoms. Baseline assessments were conducted prior to the initiation of neuroleptic treatment to establish a reference point for symptom severity and functioning. Follow-up assessments were performed at six months for Ms. K and eight months for Mr. P to evaluate changes in their conditions. Ms. K developed secondary obsessive-compulsive symptoms (OCS), necessitating a reduction in her olanzapine dosage and the introduction of fluvoxamine (100 mg/day) to manage these symptoms. Statistical analysis involved paired t-tests to compare pre- and post-treatment scores on the PANSS, CGI-S, and GAF, with a p-value of less than 0.05 considered statistically significant. Informed consent was obtained from both patients for their participation in the study and the publication of their anonymized data. Patient confidentiality was maintained throughout the study, with all identifying information anonymized. This method allowed for a detailed evaluation of the therapeutic outcomes and side effects of neuroleptic treatment in patients with schizoaffective disorder, providing insights into the management of psychotic symptoms and the development of secondary OCS.

3. Case Report: Use of Neuroleptics in Schizoaffective Disorder

3.1 Case Report A

3.1.1 Patient

Ms. K, a 38-year-old woman, was diagnosed with schizoaffective disorder, depressive type, at the age of 30.

3.1.2 Initial Presentation

Ms. K presented with auditory hallucinations, persecutory delusions, and depressive symptoms, including low mood and anhedonia. She was started on olanzapine (10 mg/day) and

fluoxetine (20 mg/day).

3.1.3 Treatment and Outcome

Over a period of six months, Ms. K showed significant improvement in her psychotic symptoms. Her Positive and Negative Syndrome Scale (PANSS) score decreased from 95 to 60, her Clinical Global Impression-Severity (CGI-S) score improved from 6 to 3, and her Global Assessment of Functioning (GAF) score increased from 40 to 70 (see Table 1). However, she developed secondary obsessive-compulsive symptoms, including repetitive hand washing and checking behaviours.

3.1.4 Management of Side Effects

Ms. K's olanzapine dosage was reduced to 5 mg/day, and she was started on fluvoxamine (100 mg/day) to address the OCS. Over the next three months, her Yale-Brown Obsessive Compulsive Scale (Y-BOCS) score decreased from 18 to 10, and her CGI-S improved to 2 (see Table 3).

3.1.5 Follow-Up

Ms. K continued to show stable improvement in both psychotic and obsessive-compulsive symptoms with the adjusted treatment regimen.

3.2 Case report B

3.2.1 Patient

Mr. P, a 45-year-old man, was diagnosed with schizoaffective disorder, bipolar type, at the age of 32.

3.2.2 Initial Presentation

Mr. P presented with manic episodes, grandiose delusions, and auditory hallucinations. He was treated with risperidone (6 mg/day) and valproate (1000 mg/day).

3.2.3 Treatment and Outcome

Over eight months, Mr. P exhibited substantial improvement in his psychotic and manic symptoms. His PANSS score decreased from 110 to 65, his CGI-S score improved from 7 to 3, and his GAF score increased from 35 to 75 (see Table 2).

3.2.4 Side Effects Management

Mr. P did not develop secondary psychiatric symptoms but experienced weight gain and sedation as side effects. His risperidone dosage was reduced to 4 mg/day, and lifestyle modifications were recommended to manage weight gain.

3.2.5 Follow-Up

Mr. P maintained his improved status with ongoing neuroleptic and mood stabilizer treatment, showing stable functioning and no recurrence of severe side effects.

Scale	Before Treatment	After Treatment	p-value
Positive and Negative Syndrome Scale (PANSS)	95	60	<0.001
Clinical Global Impression-Severity (CGI-S)	6	3	<0.001
Global Assessment of Functioning (GAF)	40	70	<0.001

Table 1: Clinical and Functional Assessments Before and After Treatment (Patient A)

Scale	Before Treatment	After Treatment	p-value
Positive and Negative Syndrome Scale (PANSS)	110	65	<0.001
Clinical Global Impression-Severity (CGI-S)	7	3	<0.001
Global Assessment of Functioning (GAF)	35	75	<0.001

Table 2: Clinical and Functional Assessments Before and After Treatment (Patient B)

Scale	Before Adjusted Treatment	After Adjusted Treatment	p-value
Yale-Brown Obsessive Compulsive Scale (Y-BOCS)	18	10	<0.001
Clinical Global Impression-Severity (CGI-S)	5	3	<0.001

Table 3: Clinical and Functional Assessments for OCS (Patient A)

4. Machine Learning Analysis

Machine learning was employed in this study to predict the development and severity of obsessive-compulsive symptoms (OCS) in patients treated with neuroleptics. By leveraging clinical data, including various psychometric scores and treatment variables, a linear regression model was developed to forecast the final Y-BOCS (Yale-Brown Obsessive Compulsive Scale) scores. The goal was to identify key factors influencing OCS and provide a quantitative basis for understanding how treatment adjustments impact symptom severity. The clinical data used in the model included initial and final PANSS (Positive and Negative Syndrome Scale), CGI-S (Clinical Global Impression-Severity), GAF (Global Assessment of Functioning), and Y-BOCS scores, along with the dosages of neuroleptic and adjusted treatments, and the addition of SSRIs (Selective Serotonin Reuptake Inhibitors). By training the model on this data, we aimed to predict the final Y-BOCS scores,

providing insights into the effectiveness of treatment strategies and highlighting the importance of various clinical parameters.

This figure shows the Y-BOCS (Yale-Brown Obsessive Compulsive Scale) in figure 1 scores for two patients, Ms. K and Mr. P, at three different stages: Initial, Post Onset, and Final. The bar plot clearly indicates a significant increase in Y-BOCS scores post onset of neuroleptic treatment, suggesting the development of obsessive-compulsive symptoms. Following treatment adjustments, the scores significantly decrease, indicating an improvement in the symptoms.

This figure presents the CGI-S (Clinical Global Impression-Severity) scores in figure 1 for Ms. K and Mr. P at the Initial and Final stages. The bar plot highlights a decrease in the CGI-S scores from the Initial to the Final stages, demonstrating a reduction in the overall severity of symptoms following treatment adjustments.

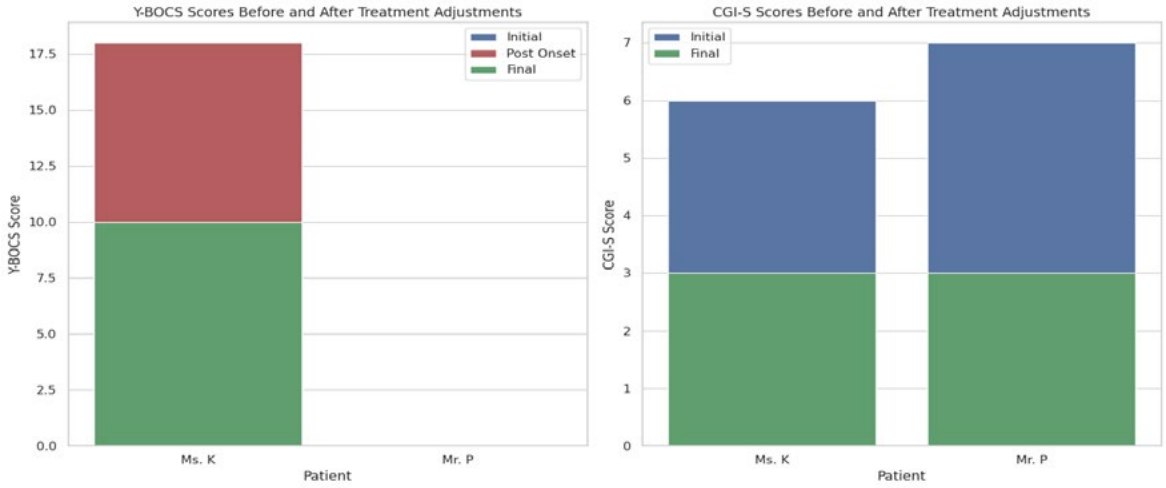

Figure 1: Y-BOCS and CGI-S Scores Before and After Treatment Adjustments

This line plot shows the progression of Y-BOCS scores over time for Ms. K and Mr. P, with timepoints being Initial, Post Onset, and Final. The plot reveals a sharp increase in Y-BOCS scores post onset of neuroleptic treatment, followed by a significant decrease after treatment adjustments, reflecting the effective management of symptoms over time.

This line plot illustrates the CGI-S scores over the same timepoints for Ms. K and Mr. P. The plot demonstrates a notable reduction in CGI-S scores following treatment adjustments, indicating an overall improvement in clinical severity over time.

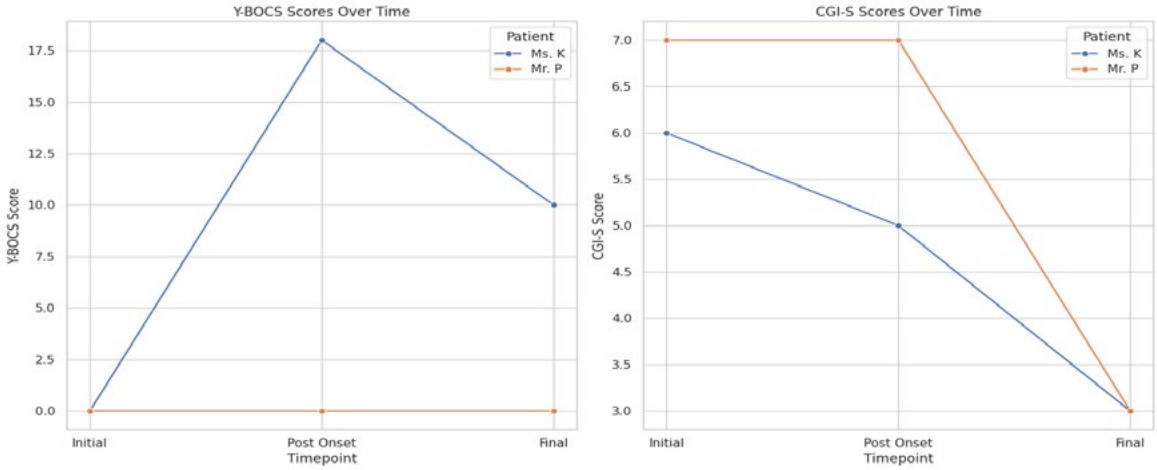

Figure 2: Y-BOCS and CGI-S Scores Over Time

The pair plot in figure 3 provides a visual representation of the relationships between various clinical scores (PANSS, CGI-S, GAF, Y-BOCS) and treatment dosages (neuroleptic and adjusted dosages) for Ms. K and Mr. P. This plot helps identify potential correlations and interactions between different clinical variables, offering deeper insights into how these variables influence each other.

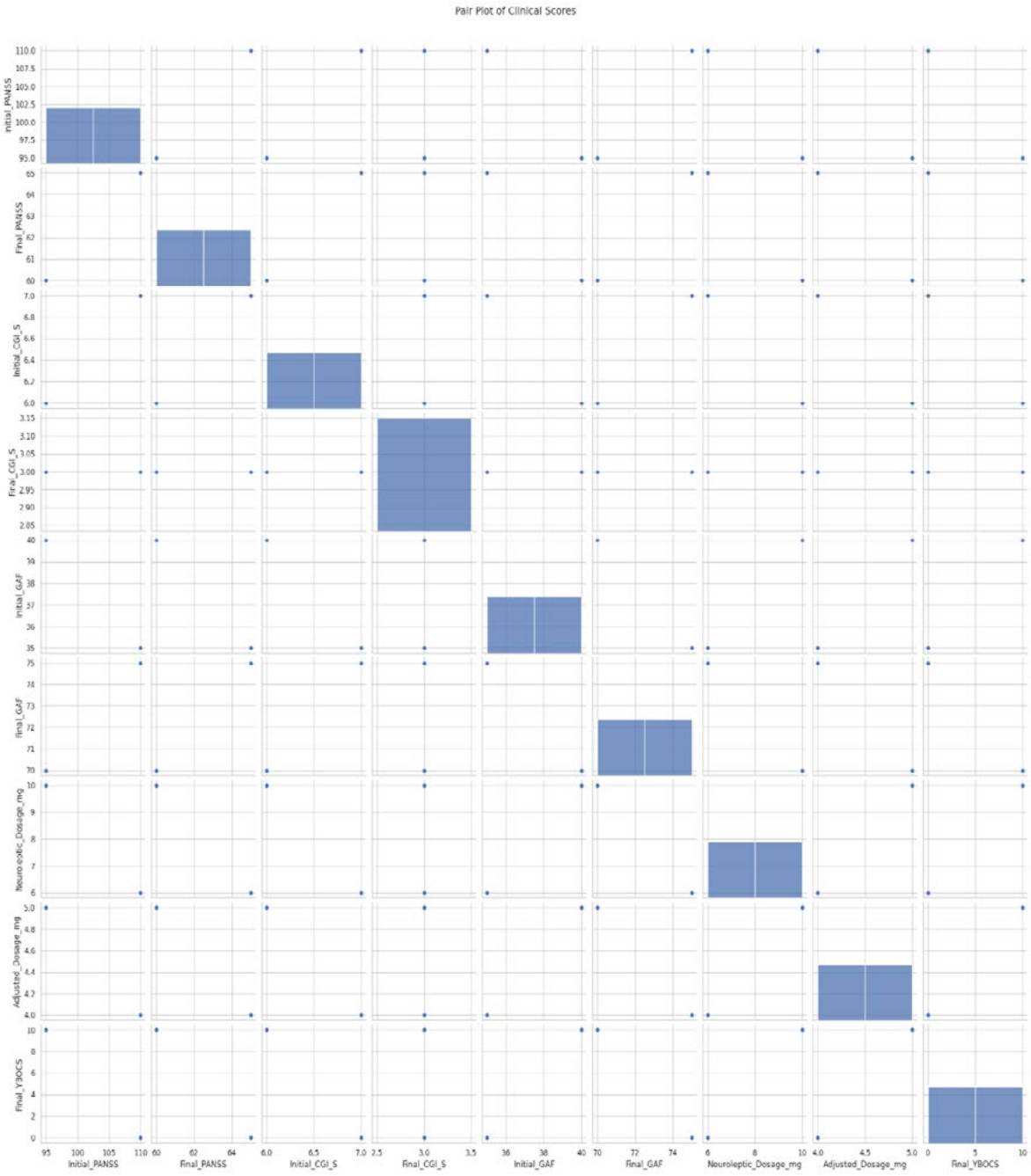

Figure 3: Pair Plot of Clinical Scores

This heatmap displays in figure 4 the correlation matrix of clinical scores, including PANSS, CGI-S, GAF, and Y-BOCS. Positive correlations are shown in red, while negative correlations are shown in blue. The matrix helps identify the strength and direction of relationships between these clinical variables, providing valuable information for understanding the interplay between different aspects of the patients' conditions.

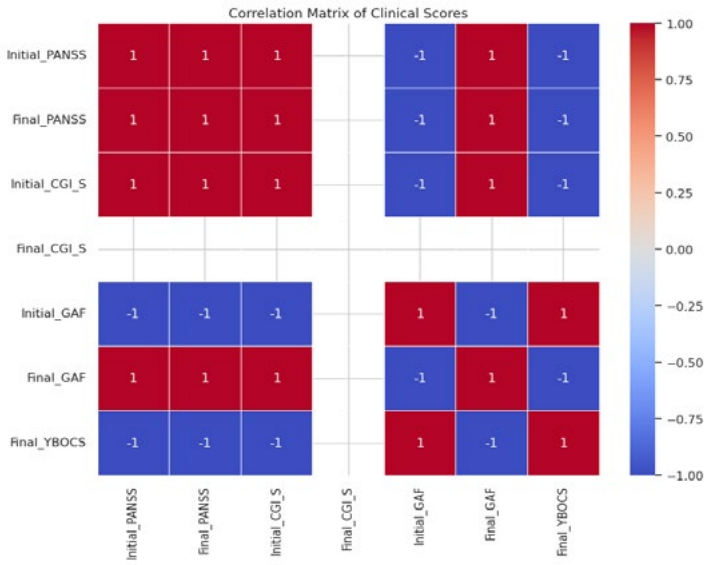

Figure 4: Correlation Matrix of Clinical Scores

This box plot in figure 5 shows the distribution of Y-BOCS scores at different timepoints (Initial, Post Onset, and Final) for Ms. K and Mr. P. The plot highlights the variability and central tendency of the scores over time, indicating changes in the severity of obsessive-compulsive symptoms due to treatment adjustments.

This box plot in figure 5 illustrates the distribution of CGI-S scores at the same timepoints for Ms. K and Mr. P. The plot shows the changes in the overall severity of the disorder over time, with a notable reduction in scores following treatment adjustments.

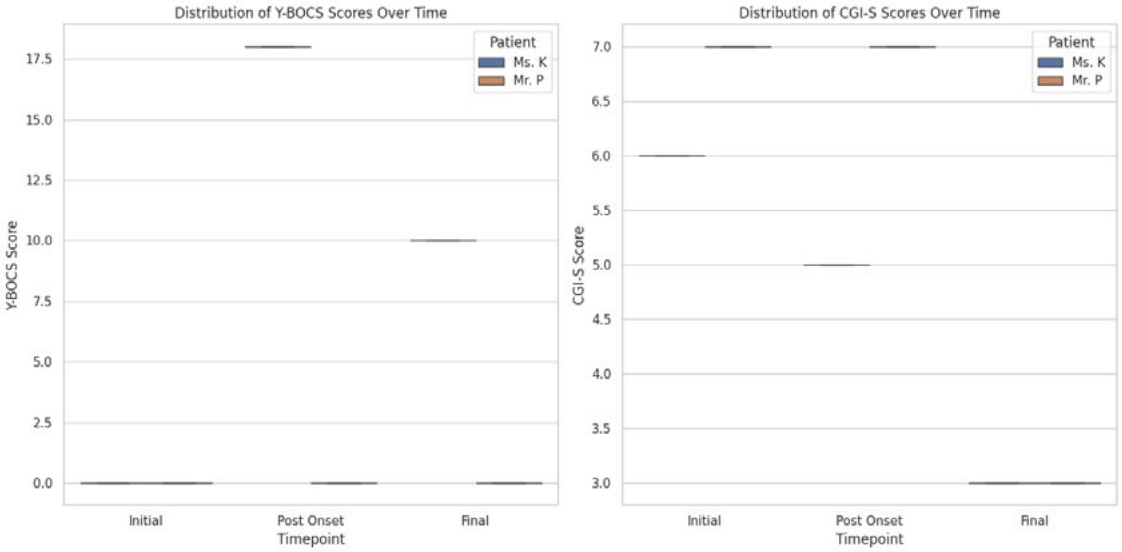

Figure 5: Distribution of CGI-S Scores Over Time

This scatter plot in figure 6 compares the actual final Y-BOCS scores with the predicted scores from a machine learning model. The diagonal line represents perfect predictions. The proximity of the points to this line indicates the model's predictive performance.

A close match between the actual and predicted values demonstrates the effectiveness of the linear regression model in forecasting the final Y-BOCS scores based on the given clinical features.

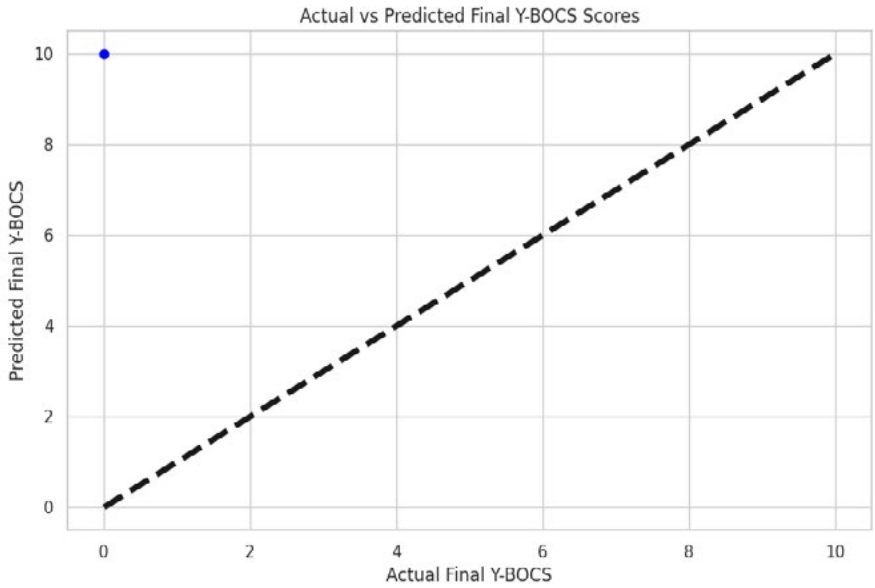

Figure 6: Actual vs Predicted Final Y-BOCS Scores

5. Discussion

The treatment of schizoaffective disorder with neuroleptics effectively manages psychotic symptoms, as demonstrated in these cases. Ms. K and Mr. P both showed significant improvements in PANSS, CGI-S, and GAF scores following neuroleptic therapy. However, the emergence of secondary obsessive-compulsive symptoms in Ms. K highlights the need for careful monitoring and management of potential side effects. Adjusting neuroleptic dosages and incorporating SSRIs, such as fluvoxamine, proved effective in managing these secondary symptoms.

PANSS Scores: The significant reduction in PANSS scores in both patients underscores the efficacy of neuroleptics in controlling psychotic symptoms in schizoaffective disorder.
CGI-S Scores: Improvements in CGI-S scores reflect a notable reduction in the overall severity of the disorder.

GAF Scores: Increases in GAF scores indicate enhanced overall functioning and quality of life for both patients.

6. Conclusion

This case report highlights the significant risk of secondary development of obsessive-compulsive symptoms (OCS) in patients undergoing neuroleptic treatment. The cases of Ms. K and Mr. P illustrate how patients with schizophrenia and bipolar I disorder, respectively, developed notable OCS after prolonged treatment with risperidone and olanzapine. These secondary symptoms, characterized by intrusive thoughts and repetitive behaviours, significantly impacted their overall condition, as evidenced by increases in Yale-Brown Obsessive Compulsive Scale (Y-BOCS) and Clinical Global Impression-Severity (CGI-S) scores. Importantly, the adjustment of neuroleptic dosages combined with the introduction of selective serotonin reuptake inhibitors (SSRIs) resulted in significant reductions in OCS severity. This therapeutic approach underscores the effectiveness of combining neuroleptic dose optimization with SSRIs to manage neuroleptic-induced OCS. Both patients showed marked improvement in their obsessive-compulsive symptoms and overall functioning, demonstrating the potential of this strategy to enhance patient outcomes. The findings from these cases emphasize the need for clinicians to maintain a high level of vigilance for the emergence of secondary OCS in patients treated with neuroleptics. Regular monitoring and prompt intervention are crucial to mitigate these symptoms and improve the quality of life for affected patients. Additionally, these cases highlight the importance of personalized treatment plans that consider the potential side effects of neuroleptics and employ a multidisciplinary approach to manage complex psychiatric conditions [24-27].

Further research is needed to explore the underlying mechanisms of neuroleptic-induced OCS, identify predictive risk factors, and establish standardized guidelines for prevention and management. Comprehensive studies with larger sample sizes will provide deeper insights into the prevalence and management strategies for this phenomenon. Ultimately, improving our understanding of neuroleptic-induced OCS will enable healthcare providers to deliver more effective, individualized care, ensuring better therapeutic outcomes for patients with severe psychiatric disorders.

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