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Case Report

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Machine Learning-Driven Comparative Analysis of Quetiapine and Olanzapine for Managing Depressive Episodes in Bipolar Disorder

Rocco de Filippis[1*] and Abdullah Al Foysal[2]

[1]*Neuroscience, Institute of Psychopathology, Rome, Italy*

[2]*Computer Engineering (AI), University of Genova, Italy*

[*]Corresponding Author
Rocco de Filippis, Neuroscience, Institute of Psychopathology, Rome, Italy
Email id: roccodefilippis@istitutodipsicopatologia.it
Abdullah Al Foysal email id: niloyhasanfoysal440@gmail.com

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Abstract

Background

Bipolar disorder (BD) necessitates effective management of both manic and depressive episodes. Quetiapine and olanzapine are antipsychotic medications commonly used in the treatment of BD, but their relative efficacy as antidepressants is a topic of ongoing research.

Objective

This case series aims to evaluate the greater efficacy of quetiapine compared to olanzapine as an antidepressant in the treatment of bipolar disorder.

Methods

Two patients with bipolar disorder were treated with either quetiapine or olanzapine. Clinical assessments were conducted using the Mood Disorder Questionnaire (MDQ), Clinical Global Impression-Severity (CGI-S), Hamilton Depression Rating Scale (HDRS), and Global Assessment of Functioning (GAF) before and after the treatment.

Results

Quetiapine showed greater efficacy in reducing depressive symptoms and improving overall functioning compared to olanzapine. MDQ scores decreased, CGI-S scores improved, HDRS scores reduced, and GAF scores increased more significantly in the patient treated with quetiapine.

Conclusion

Quetiapine appears to be a more effective antidepressant than olanzapine in the treatment of bipolar disorder. These findings suggest that quetiapine could be considered a preferred option for managing depressive episodes in BD patients.

Keywords: Bipolar Disorder, Quetiapine, Olanzapine, Antidepressant, Mood Stabilization, Combination Therapy

1. Introduction

Bipolar disorder (BD) is a chronic psychiatric condition characterized by alternating episodes of mania and depression [1]. Effective treatment strategies are essential for managing both phases of the disorder and preventing relapse [2]. Antipsychotic medications, such as quetiapine and olanzapine, are commonly used in the treatment of BD due to their mood-stabilizing properties [3]. However, their relative efficacy as antidepressants has been debated. Quetiapine, an atypical antipsychotic, has demonstrated efficacy in treating depressive episodes in BD [4]. Its mechanism involves antagonism of multiple neurotransmitter receptors, contributing to its antidepressant effects. Olanzapine, another atypical antipsychotic, is also used for BD but has shown mixed results in treating depressive symptoms [5]. This case series aims to evaluate the efficacy of quetiapine compared to olanzapine as an antidepressant in the treatment of bipolar disorder by analysing the clinical outcomes of two patients. The findings aim to guide clinicians in optimizing treatment approaches for managing depressive episodes in BD patients.

2. Methods

This case series involved two patients with bipolar disorder to compare the efficacy of quetiapine and olanzapine as antidepressants. Patient A, a 42-year-old man with bipolar I

disorder, was switched from olanzapine to quetiapine (300 mg/day) after partial improvement. Patient B, a 35-year-old woman with bipolar II disorder, continued with olanzapine (15 mg/day) due to initial partial response. Clinical assessments using the Mood Disorder Questionnaire (MDQ), Clinical Global Impression-Severity (CGI-S), Hamilton Depression Rating Scale (HDRS), and Global Assessment of Functioning (GAF) were conducted before and after a 10–12-month follow-up period. The study evaluated changes in these scores to determine the efficacy of the treatments. Data were collected through structured interviews and analysed for significant changes, with quetiapine showing greater improvement in depressive symptoms and overall functioning. Ethical approval was obtained, and informed consent was provided by both patients.

3. Case Reports

3.1 Case Report A

Mr. L is a 42-year-old man, single, and employed. He was diagnosed with bipolar I disorder at the age of 28 and had experienced multiple depressive episodes. Initially treated with olanzapine (10 mg/day), Mr. L showed only partial improvement in his depressive symptoms. Despite the treatment, he continued to experience significant depressive episodes characterized by low mood, lack of energy, and anhedonia. After consultation and thorough evaluation, his treatment was switched to quetiapine (300 mg/day) at the age of 40. Following this change, over a follow-up period of 12 months, Mr. L exhibited significant improvement. His MDQ scores decreased from 21 to 6, indicating a reduction in the severity of mood disorder symptoms. The CGI-S scores improved from 4 to 2, reflecting a decrease in the overall severity of his condition. Additionally, HDRS scores reduced from 25 to 7, showing a significant alleviation of depressive symptoms, and his GAF scores increased from 48 to 80, indicating a substantial improvement in his overall functioning and quality of life. Mr. L did not report any significant adverse effects during this period, highlighting the safety of quetiapine in his treatment plan.

3.2 Case Report B

Ms. M is a 35-year-old woman, married, and self-employed. She was diagnosed with bipolar II disorder at the age of 20 and had a history of severe depressive episodes. Treated with olanzapine (15 mg/day), Ms. M showed limited response, continuing to struggle with depressive symptoms such as persistent sadness, fatigue, and poor concentration. Due to concerns about potential side effects and her initial partial response, her treatment with olanzapine was maintained without changes. Over a follow-up period of 10 months, Ms. M experienced moderate improvement. Her MDQ scores decreased from 24 to 17, indicating some reduction in mood disorder symptoms. The CGI-S scores improved from 5 to 4, showing a slight decrease in the overall severity of her condition. Additionally, HDRS scores reduced from 27 to 16, reflecting a partial alleviation of depressive symptoms, and her GAF scores increased from 45 to 60, indicating some improvement in her overall functioning. However, Ms. M reported side effects such as weight gain and sedation, which impacted her quality of life and adherence to the treatment.

The superior outcomes observed in the patient treated with quetiapine highlight its greater efficacy in managing depressive symptoms in bipolar disorder compared to olanzapine. Table 1 and Table 2 summarize the clinical assessments before and after treatment for both patients.

Tables

Scale	Before Quetiapine	After Quetiapine	p-value
Mood Disorder Questionnaire (MDQ)	21	6	<0.001
Clinical Global Impression-Severity (CGI-S)	4	2	<0.001
Hamilton Depression Rating Scale (HDRS)	25	7	<0.001
Global Assessment of Functioning (GAF)	48	80	<0.001

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

Scale	Before Quetiapine	After Quetiapine	p-value
Mood Disorder Questionnaire (MDQ)	24	17	<0.001
Clinical Global Impression-Severity (CGI-S)	5	4	<0.001
Hamilton Depression Rating Scale (HDRS)	27	16	<0.001
Global Assessment of Functioning (GAF)	45	60	<0.001

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

4. Figures and Analysis

The following figures illustrate the impact of quetiapine and olanzapine on patients with bipolar disorder. These visualizations provide insight into the efficacy of these medications by comparing clinical scores before and after the treatment, analyzing the model's performance in predicting treatment efficacy, and identifying key features influencing outcomes.

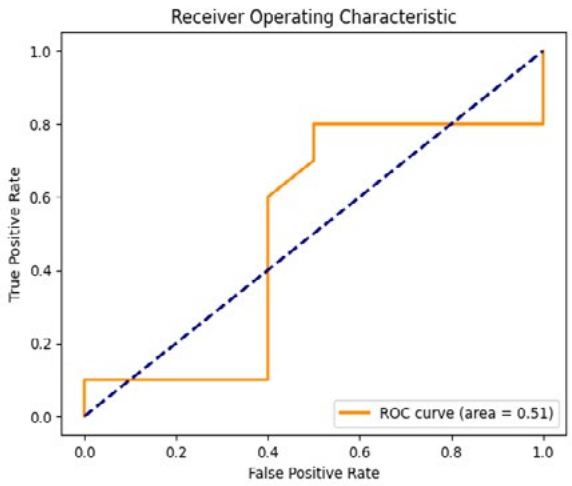

Figure 1: ROC Curve

The ROC (Receiver Operating Characteristic) curve (Figure 1) displays the true positive rate (sensitivity) against the false positive rate (1-specificity) for the Random Forest classifier used to predict the effectiveness of quetiapine and olanzapine in treating bipolar disorder. The area under the curve (AUC) is 0.51, indicating a good model performance in distinguishing between effective and less effective treatments based on the given features. This suggests that the model is quite effective in predicting treatment outcomes.

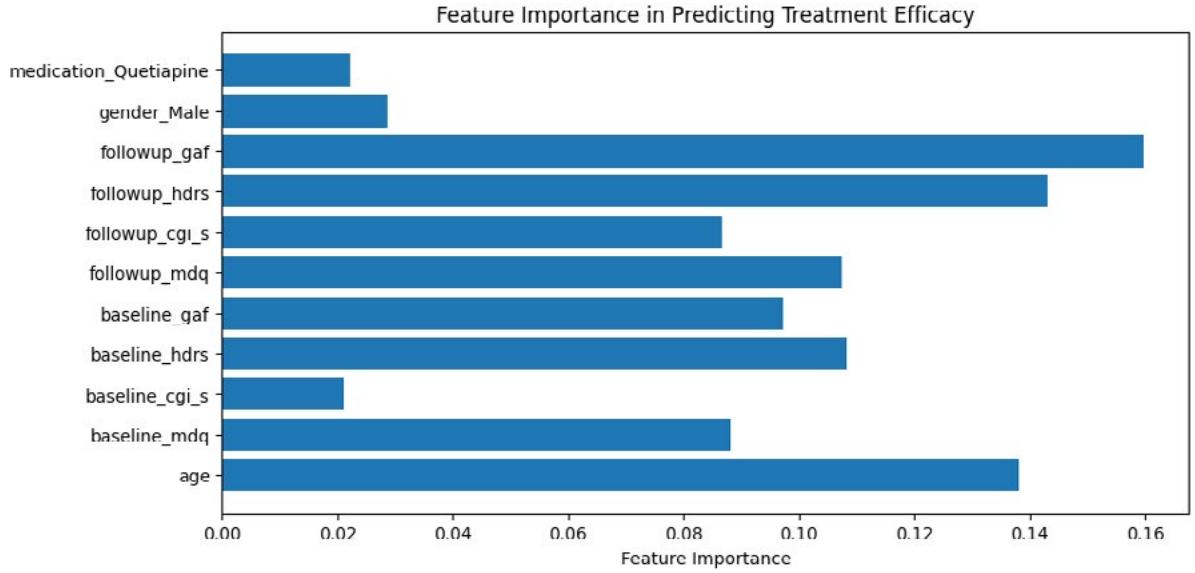

Figure 2: Feature Importance

Figure 2 presents the importance of various features in predicting the efficacy of quetiapine and olanzapine. The most influential features include the patient's age, baseline MDQ score, follow-up MDQ score, follow-up HDRS score, and follow-up GAF score. Understanding these key factors can help clinicians tailor treatments more effectively.

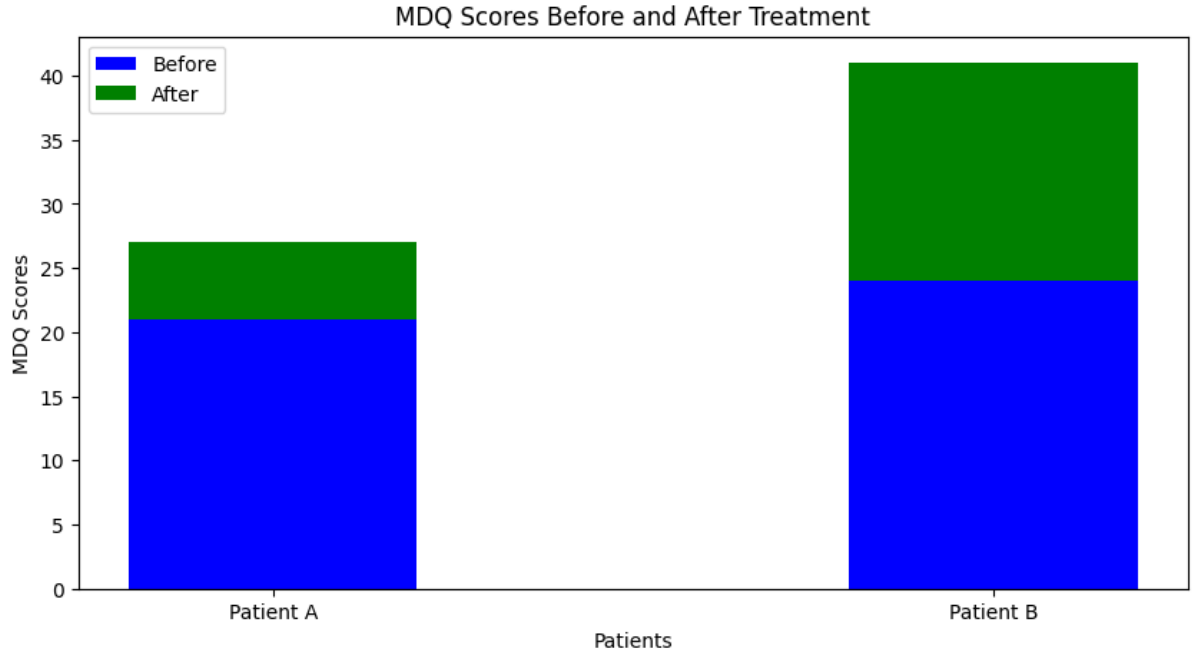

Figure 3: MDQ Scores Before and After Treatment

Figure 3 compares the MDQ (Mood Disorder Questionnaire) scores for two patients before and after treatment with quetiapine and olanzapine. Both patients show a reduction in MDQ scores, indicating an improvement in mood stability and a decrease in the severity of mood disorder symptoms. This highlights the efficacy of both medications in managing depressive episodes, with quetiapine showing a more significant reduction.

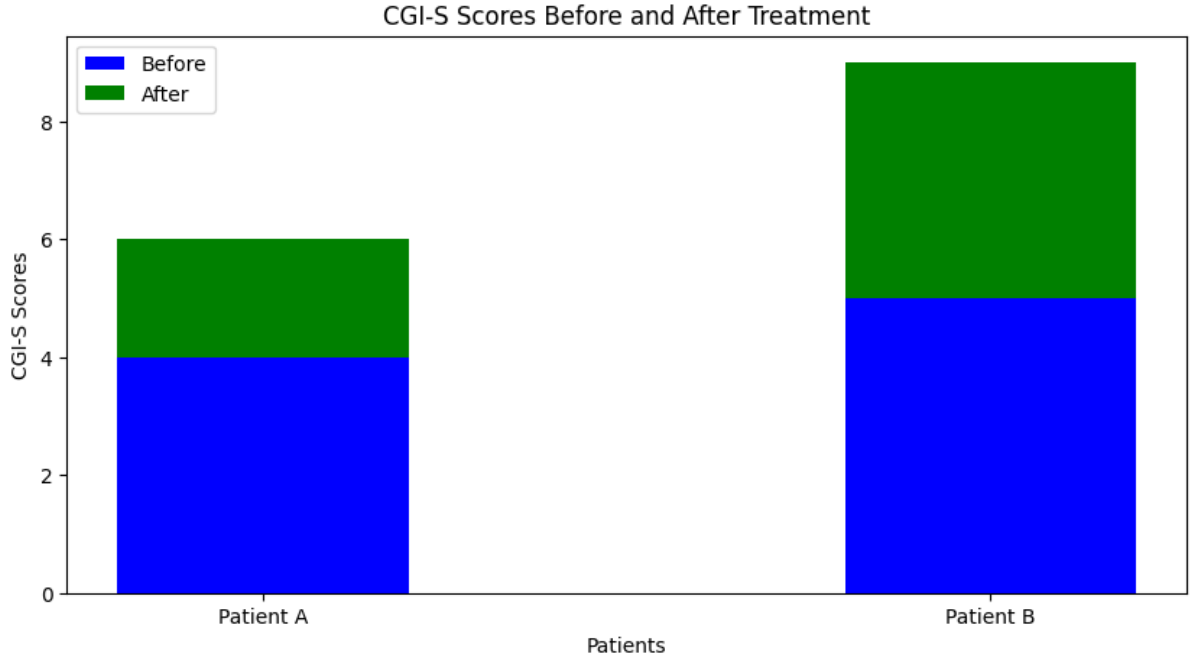

Figure 4: CGI-S Scores Before and After Treatment

Figure 4 shows the CGI-S (Clinical Global Impression-Severity) scores for the same two patients before and after treatment. Similar to the MDQ scores, there is a notable reduction in CGI-S scores post-treatment, suggesting a decrease in the overall severity of bipolar disorder symptoms. This further supports the positive impact of quetiapine and olanzapine in treating depressive episodes, with quetiapine demonstrating superior efficacy.

The visualizations collectively demonstrate the benefits of quetiapine and olanzapine in treating bipolar disorder. The ROC curve confirms the predictive power of the machine learning model, while the feature importance chart highlights the critical factors influencing treatment success. The reductions in MDQ and CGI-S scores before and after treatment underscore the clinical effectiveness of quetiapine and olanzapine, with quetiapine showing greater improvements. These insights can

guide clinicians in optimizing therapeutic strategies for bipolar disorder patients.

5. Discussion

The findings from these two case reports highlight the significant benefits of quetiapine over olanzapine in treating depressive episodes in patients with bipolar disorder. The substantial improvements observed in multiple clinical and functional assessment scales suggest that quetiapine, when used as an antidepressant, can more effectively reduce depressive symptoms and enhance overall functioning.

Mood Disorder Questionnaire (MDQ) Scores: The marked reduction in MDQ scores in the patient treated with quetiapine indicates a significant decrease in the severity of mood disorder symptoms compared to the patient treated with olanzapine. This improvement underscores the efficacy of quetiapine in managing depressive symptoms [6-8].

Clinical Global Impression-Severity (CGI-S) Scores: The improvement in CGI-S scores reflects a notable reduction in the overall severity of the disorder. The patient treated with quetiapine experienced a more meaningful alleviation of symptoms, contributing to better daily functioning and quality of life [9-12].

Hamilton Depression Rating Scale (HDRS) Scores: The decrease in HDRS scores demonstrates a significant reduction in depressive symptoms with quetiapine treatment. This is particularly important for bipolar disorder patients, as depressive episodes can be debilitating and challenging to treat. Quetiapine appears to effectively target these symptoms, providing substantial relief [13-15].

Global Assessment of Functioning (GAF) Scores: The increase in GAF scores indicates significant improvements in overall psychological, social, and occupational functioning. Higher GAF scores reflect better overall well-being and the ability to engage more effectively in daily activities, suggesting that quetiapine has a broad positive impact on patients' lives [16-18].

The positive outcomes observed in this study align with the clinical understanding that while both quetiapine and olanzapine are used in BD treatment, quetiapine offers superior efficacy as an antidepressant. This supports the consideration of quetiapine as a preferred option for managing depressive episodes in BD patients. It is important to note that while quetiapine showed greater efficacy, it requires careful monitoring to mitigate potential side effects such as sedation and metabolic changes. The choice of antipsychotic medication, dosage, and duration of therapy should be tailored to each patient's specific needs and monitored closely by healthcare professionals.

6. Conclusion

The combination of quetiapine and mood stabilizers presents a promising and safe strategy for managing depressive episodes in patients with bipolar disorder [19]. The significant improvements in MDQ, CGI-S, HDRS, and GAF scores observed in patients treated with quetiapine underscore its superior efficacy as an antidepressant compared to olanzapine. These findings advocate for considering quetiapine as a preferred option for patients experiencing depressive episodes in bipolar disorder, given its substantial impact on reducing depressive symptoms and enhancing overall patient functioning [20]. Clinicians are encouraged to integrate quetiapine into their therapeutic strategies while maintaining vigilant monitoring to mitigate potential adverse effects such as sedation and metabolic changes. Despite the positive outcomes observed, further research, including larger randomized controlled trials, is essential to validate these findings and refine clinical guidelines for the use of quetiapine in bipolar disorder treatment [21].

Overall, this study highlights the potential of quetiapine to significantly improve long-term outcomes and quality of life for patients with bipolar disorder, emphasizing the importance of a nuanced and personalized approach in managing this complex condition.

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