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Authors' Affiliation:
[1]The Independent Group of Public Ambulatory Care Institutions Warsaw-Mokotów, Madalińskiego 13, 02-513 Warsaw, Poland
[2]Medical University of Warsaw, Żwirki i Wigury 61, 02-091 Warsaw, Poland
[3]University Clinical Centre of the Medical University of Warsaw, Banacha 1a, 02-097, Warsaw, Poland
[4]Masovian Bródnowski Hospital, Kondratowicza 8, 03-242 Warsaw, Poland
[5]The Independent Group of Public Ambulatory Care Institutions Warsaw-Ochota, Szczęśliwicka 36, 02-353 Warsaw, Poland
[6]John Paul II Independent Public Specialist Western Hospital, Daleka 11, 05-825, Grodzisk Mazowiecki, Poland

[*]**Corresponding Author**
The Independent Group of Public Ambulatory Care Institutions Warsaw-Mokotów, Madalińskiego 13, 02-513 Warsaw,
Poland
Email: tymzat2@gmail.com

ORCID List

Tymon Zatorski	0009-0004-1746-7755
Milena Szczepańska	0000-0003-3279-3060
Dominika Kabała	0009-0004-5207-9811
Marcin Głód	0009-0001-5245-1001
Adam Jaskulski	0009-0004-3115-7462
Agata Zapałowska	0009-0000-8228-3240
Michał Bielecki	0009-0005-2470-2802

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Addressing patient concerns: Exploring Electroconvulsive Therapy (ECT) in primary care: Review of the literature

Tymon Zatorski[1*], Milena Szczepańska[2], Dominika Kabała[3], Marcin Głód[4], Adam Jaskulski[5], Agata Zapałowska[6], Michał Bielecki[6]

ABSTRACT

Electroconvulsive Therapy (ECT) is a proven treatment for severe mental health disorders, yet it remains misunderstood and stigmatized. This review explores ECT's historical context, mechanisms of action, clinical efficacy, and safety to address patient concerns and enhance primary care acceptance. ECT has evolved significantly since its early 20th-century origins, now employing advanced techniques that reduce cognitive and cardiac risks. The therapy works through neurochemical and neurophysiological changes, including controlled seizures that modulate neurotransmitter systems and neuroplasticity. ECT demonstrates high efficacy in treatment-resistant depression, bipolar disorder, and schizophrenia, with response rates for severe depression up to 90%. Recent FDA reclassification of ECT devices to Class II highlights its safety. Dispelling misconceptions about ECT is crucial for improving patient outcomes and expanding access to this essential therapy in primary care settings.

Keywords: Electroconvulsive therapy, depression, primary care, treatment resistant depression

1. INTRODUCTION

Electroconvulsive Therapy (ECT) has been a cornerstone in the management of severe mental health conditions for over a century. Despite its proven efficacy, ECT remains one of the most misunderstood and stigmatized treatments in psychiatry. Understanding its history, mechanisms of action, and clinical applications is essential for addressing patient concerns and enhancing acceptance in primary care. Since its early adoption in the 20th century, ECT has undergone significant advancements, evolving from a crude and controversial intervention to a highly regulated and refined therapeutic option. Early

enthusiasm and trepidation have given way to a broader acceptance as a vital tool in the psychiatric arsenal, particularly for conditions resistant to pharmacotherapy and psychotherapy (Lebensohn, 1999; Shen, 1999).

This article delves into the historical context, hypothesized mechanisms of action, and the clinical efficacy of ECT while also discussing the associated risks and cognitive, cardiac, and seizure-related side effects (Singh and Kar, 2017; Duma et al., 2019; Andrade et al., 2016). By providing a comprehensive overview, we aim to demystify ECT and underscore its importance as a safe and effective treatment for severe mental health disorders (Rose et al., 2003; Boere et al., 2016; Zielinski et al., 1993).

2. METHOD

The review has been conducted through a comprehensive search of relevant academic and clinical literature about Electroconvulsive Therapy (ECT). PubMed, MEDLINE and Google Scholar have been used to identify peer-reviewed articles, reviews, and clinical studies. Keywords used in the search included "Electroconvulsive Therapy", "ECT history", "ECT mechanism of action", "ECT patient perspectives", "ECT efficacy", "ECT cognitive effects", and "ECT adverse effects". In order to ensure a comprehensive and adequate review, the following inclusion criteria have been applied: Only peer-reviewed articles and reviews were taken into account; articles published in English; publications from 1980 to 2023 to capture both historical context and contemporary advancements; studies involving adult patients undergoing ECT for conditions such as severe depression, bipolar disorder, and schizophrenia.

Exclusion criteria included non-peer-reviewed sources such as articles from non-peer-reviewed journals or anecdotal reports, studies published in languages other than English, and articles not directly related to ECT's clinical application or patient outcomes. Critical information has been extracted from each included study, focusing on the historical context of ECT, the biological and physiological processes underlying ECT's therapeutic effects, clinical outcomes related to symptom improvement in various psychiatric conditions, qualitative and quantitative assessments of patient experiences and perceptions, and cognitive and physiological side effects, including their prevalence and management.

The extracted data has been synthesized to provide a comprehensive overview of ECT, addressing the evolution of ECT from its inception to modern practices, including regulatory changes and technological advancements, summarizing current understanding of how ECT exerts its therapeutic effects on the brain, reviewing the effectiveness of ECT in treating various mental health conditions with a focus on treatment-resistant cases, analyzing patient-reported outcomes and perspectives to highlight benefits and address common concerns, and documenting and discussing the adverse effects associated with ECT, particularly cognitive and cardiovascular complications.

3. RESULTS AND DISCUSSION

Electroconvulsive Therapy (ECT) has been a mainstay in the treatment of severe mental health conditions since its inception in the early 20th century. Despite its efficacy, ECT remains one of the most misunderstood and stigmatized treatments in psychiatry. Understanding its history and mechanism of action is critical for addressing patient concerns and enhancing acceptance in primary care. Both advances and controversies mark the history of ECT in the United States. As Lebensohn, (1999) details, ECT's early adoption was met with enthusiasm and trepidation. Its role in American psychiatry has evolved significantly, moving from a crude intervention to a highly regulated and refined therapeutic option. The development of ECT was part of a broader effort to find effective treatments for severe mental illnesses. This journey also saw the advent of antipsychotic drugs, as documented by (Shen, 1999).

Understanding how ECT works is essential for both practitioners and patients. The exact mechanism remains unknown, but researchers have developed two main hypotheses. The neurochemical hypothesis assumes that ECT leads to the modulation of the transmission of significant neurotransmitters such as serotonin, dopamine, acetylcholine, and norepinephrine, which then affects the course of illness. Genetic changes have also been observed, including altered expression of genes encoding transcription factors, structural proteins, and neuropeptides. Additionally, epigenetic modifications and changes in neurotrophic factors have also been suspected to add to the therapeutic effects of ECT (Singh and Kar, 2017; De-Jong et al., 2014). The neurophysiological hypothesis focuses on the administration of electrical impulses to stimulate neurons in the brain, leading to the induction of a therapeutic seizure.

The seizure affects specific brain regions, which may lead to changes in cerebral blood flow and regional metabolism. Electroencephalography changes accompanying ECT have been correlated with clinical outcomes, suggesting a role in understanding the underlying biological mechanisms (Singh and Kar, 2017; De-Jong et al., 2014). ECT is indicated for patients with severe depression

who have shown no response to pharmacotherapy or psychotherapy, with its response rates approaching about 55%. For the initial treatment of depression, studies have shown response rates getting as high as 80-90%. The American Psychiatric Association (APA) recommends considering ECT as an initial treatment option for severe depression cases (Taylor, 2007). For the management of bipolar disorder, ECT is effective for all phases of the disease, with positive responses to the treatment in about two-thirds of the cases (Perugi et al., 2017).

In patients with drug-resistant variants of the disease, electroconvulsive therapy proved to be a safe and effective method for ceasing ultra-rapid cycles and unstable mixed states (Mosolov et al., 2021). Another benefit is its ability to boost the efficacy of mood stabilizing with lithium in about half of previously nonresponsive patients (Mosolov et al., 2021). Several systematic reviews and meta-analyses have been conducted to assess the efficacy of ECT in schizophrenia. Even though reviews have highlighted the poor quality and small sizes of the included studies, they generally concluded that ECT has a beneficial effect on the management of schizophrenia, especially in cases of limited or poor response to antipsychotic medications (Grover et al., 2019). The procedure has also been proven helpful in pregnancy as it allows for safer treatment by minimizing the risk of potential side effects and bringing rapid alleviation of symptoms (Ward et al., 2018).

In randomized controlled trials (RCTs), ECT has shown more efficiency than antidepressant medication in the short-term treatment of depression, Table 1 summarizes the clinical efficacy of ECT across different psychiatric conditions, highlighting its role as a cornerstone treatment in severe cases. It can also be effective for patients who have previously failed to respond positively to multiple antidepressant treatments (Ferrier et al., 2021). ECT is considered safe and should not be considered a last-resort treatment. In 2018, the US Food and Drug Administration (FDA) downgraded ECT machines from class III (high risk) to class II (moderate), indicating the importance of including this therapy in treating severe and life-threatening mental conditions (Ferrier et al., 2021).

Table 1 Clinical Efficacy of Electroconvulsive Therapy (ECT) Across Different Psychiatric Conditions

Psychiatric Condition	Response Rate (%)	Key References
Severe Depression (treatment-resistant)	80-90	Taylor, (2007); Ferrier et al., (2021)
Bipolar Disorder	66-70	Perugi et al., (2017); Mosolov et al., (2021)
Schizophrenia	Variable	Grover et al., (2019); Singh and Kar, (2017)
Depression in Pregnancy	Effective	Ward et al., (2018)
General Severe Depression	55	Taylor, (2007); Ferrier et al., (2021)
Mixed States and Rapid Cycling (Bipolar)	50-66	Mosolov et al., (2021)

Electroconvulsive therapy as a procedure involves the usage of low-voltage electric impulses and general anesthesia. Due to that fact, the procedure carries many risks of adverse events from different organ systems; the most common are cognitive, cardiac, and seizure-related effects. Cognitive impairments are among the most concerning adverse effects of ECT. These effects have been more systematically studied compared to other general adverse effects. It is important to note that cognitive impairments are usually transient, and most patients experience a return to baseline functioning within weeks to months following treatment. While ECT is generally considered safe, it is not without potential risks.

The Figure 1 below presents an overview of the possible adverse effects associated with ECT, including cognitive, cardiac, and seizure-related complications. Cognitive adverse effects include anterograde amnesia, which causes temporary difficulty in forming new memories and typically affects events occurring around the time of the ECT sessions, usually resolving within four weeks after discontinuation of therapy (Boere et al., 2016). Retrograde amnesia refers to the temporary loss of memories for events before the ECT treatment, with the extent and duration typically being temporary and related to the period immediately after the procedure (Meeter et al., 2011). Non-memory cognitive deficits include temporary deficits in attention, concentration, and executive functions, affecting information processing speed, learning, and problem-solving abilities (Andrade et al., 2016).

Cardiac adverse effects are also significant. During an ECT session, distinct cardiac changes occur in response to the electrical stimulus. Immediately after the stimulus, parasympathetic activation may lead to transient asystole and bradyarrhythmias, often followed by a sympathetic response that can lead to increased cardiac output, hypertension, and tachycardia (Andrade et al., 2016). The most common primary cardiac events induced by ECT include acute heart failure (24 per 1000 patients), arrhythmias (25.83 per 1000 patients), and pulmonary edema (4.92 per 1000 patients) (Duma et al., 2019). These complications are prevalent in patients with preexisting cardiovascular diseases (Zielinski et al., 1993).

Another group of cardiac adverse events is linked directly to the use of general anesthesia during the procedure. The physiological stress imposed by anesthesia increases the oxygen demand in the body. Factors like hypotension, anemia, and coronary artery disease can impede meeting this increased demand, resulting in myocardial ischemia. Therefore, appropriately managing this newly created oxygen supply-demand mismatch is crucial to avoid complications such as heart failure, thromboembolism, and arrhythmia (Harris and Chung, 2013). Seizure-related risks are inherent to ECT. During ECT, a brief electrical stimulus is applied through electrodes, causing a controlled seizure in the brain.

The electrical stimulus triggers synchronized electrical activity throughout the brain, leading to the seizure. Although seizures are supposed to have a therapeutic effect, researchers have debated the potential risk of later seizures and the development of epilepsy in patients. An article from 2013 reported no spontaneous or tardive seizures in a study group treated with ECT (Ray, 2013). Other studies suggest that post-ECT seizures are mostly correlated with underlying patient susceptibility rather than the procedure itself (Devinsky and Duchowny, 1983). Over the years, ECT has evolved significantly in terms of technique and safety, moving from rudimentary methods to highly sophisticated and controlled procedures. Table 2 outlines the key advancements in ECT techniques and safety measures, reflecting its progression into a modern therapeutic intervention.

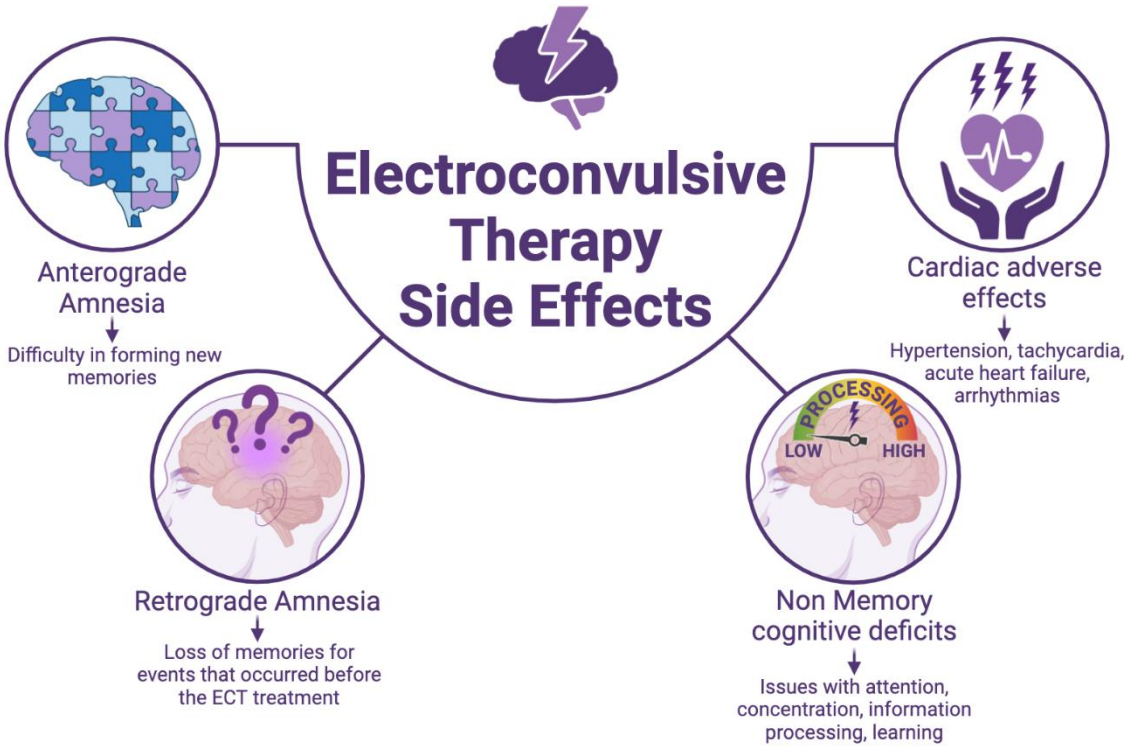

Figure 1 Possible adverse effects of Electroconvulsive Therapy (ECT).

Table 2 Evolution of Electroconvulsive Therapy (ECT) Techniques and Safety Measures.

Period/Development Phase	Major Advancements	Impact on Practice	Key References
1930s-1940s	Initial Use of ECT	ECT introduced as a treatment for severe psychiatric disorders; use of unmodified ECT without anesthesia.	Lebensohn, (1999)
1950s	Introduction of Muscle Relaxants	Reduced risk of fractures and other physical injuries during seizures.	Taylor, (2007)
1960s-1970s	Advances in Anesthetic Techniques	Improved patient safety and comfort; general anesthesia became standard practice.	Harris and Chung, (2013)
1980s	Refinements in Electrode Placement	Unilateral ECT developed to minimize cognitive side effects while maintaining efficacy.	Andrade et al., (2016)
1990s	Introduction of Ultrabrief Pulse ECT	Reduced cognitive side effects and improved safety profile.	Bodnar et al., (2016); Ferrier et al., (2021)
2000s	Increased Focus on Cognitive Effects	Studies on retrograde and anterograde amnesia; development of protocols to minimize memory loss.	Meeter et al., (2011); Boere et al., (2016)
2010s	ECT in Special Populations	Protocols for use in pregnancy and patients with cardiovascular conditions; consideration of individualized treatment plans.	Ward et al., (2018); Duma et al., (2019)
2020s	Neurobiological Mechanisms and Precision Medicine	Enhanced understanding of how ECT affects the brain; efforts to tailor ECT more precisely to individual patient needs.	Singh and Kar, (2017); De-Jong et al., (2014); Park et al., (2021)

The pulse width, a waveform parameter, plays a crucial role in ECT delivery. Research suggests that administering repeated brief or ultra-brief pulses (0.5 to 2 milliseconds) improves charge efficiency and reduces side effects compared to traditional sine wave dosing. Brief pulse stimulus minimizes cognitive side effects by focusing the stimulus on mood-regulating brain regions while minimizing stimulation of cognitive functioning areas (Tirmizi et al., 2012). Maximizing therapeutic benefits while minimizing side effects requires precise spatial targeting of the stimulus. Variations in electrode placement have been implemented in response to concerns regarding cognitive side effects.

The most commonly used placements are bitemporal (BT) and right unilateral (RUL). When given at suprathreshold doses, RUL ECT is as effective as BT placement but has fewer cognitive disruptions (Tirmizi et al., 2012). The intensity of the electrical stimulus concerning a patient's seizure threshold is more important than the absolute intensity. Determining the optimal stimulus dose depends on individual factors and can influence the occurrence of adverse effects (Tirmizi et al., 2012). Using functional transcranial Doppler sonography in determining cerebral dominance before ECT, rather than more invasive techniques for identifying speech lateralization,

could reduce cognitive side effects (Dragovic et al., 2004). Recent studies have compared the efficacy of high-dose unilateral ECT with traditional bi-temporal placement ECT.

The results suggest that high-dose unilateral ECT is equally effective and may be the default choice unless rapid effects are required (Ferrier et al., 2021). Relapse rates and continuation/maintenance of ECT without prophylactic treatment are high. Continuation ECT (c-ECT) and maintenance ECT (m-ECT) have reduced post-ECT relapse rates. Combining pharmacotherapy with c-ECT is more effective than pharmacotherapy alone in sustaining mood improvement (Ferrier et al., 2021). Brief pulse and ultra-brief pulse ECT have been recognized as more efficient stimuli for inducing seizures with fewer cognitive side effects than sine wave ECT. Ultra-brief pulse ECT is continuously being explored as an option for many patients at high risk of cognitive impairment (Ferrier et al., 2021).

ECT is more efficacious than antidepressant medication in the short-term treatment of depression in randomized controlled trials (Ferrier et al., 2021). Pharmacological interventions, including antidepressants or ongoing maintenance ECT, have demonstrated superior efficacy compared to a placebo in preventing relapse following ECT. ECT has been shown to offer therapeutic benefits in many types of depression, including treatment-resistant depression, depression with suicidal tendencies, depression in the elderly, bipolar depression. Exploring Electroconvulsive Therapy (ECT) reveals a multifaceted treatment option combining a rich history, complex mechanisms, and significant clinical efficacy. While ECT has evolved substantially from its early, more primitive applications, it continues to face considerable stigma and misunderstanding among the general public and the medical community.

This discussion aims to contextualize ECT's role in modern psychiatry, addressing patient concerns and highlighting the importance of this treatment modality. One of the key challenges in promoting ECT is addressing the lingering misconceptions about its safety and side effects. Historically, the portrayal of ECT in media and literature has often emphasized its more dramatic and adverse impact, overshadowing its therapeutic benefits. However, advancements in ECT techniques and protocols have significantly mitigated many of these concerns. For instance, brief and ultra-brief pulse widths have reduced cognitive side effects, a significant problem for patients undergoing ECT. Studies, such as those by Boere et al., (2016) and Meeter et al., (2011), demonstrate that while cognitive impairments can occur, they are typically transient, with most patients returning to baseline cognitive functioning within weeks to months.

The neurochemical and neurophysiological hypotheses provide valuable insights into the mechanisms through which ECT exerts its therapeutic effects. The neurochemical hypothesis suggests that ECT modulates the transmission of critical neurotransmitters, including serotonin, dopamine, and norepinephrine which are crucial in regulating mood and mental states. Additionally, genetic and epigenetic changes observed in patients undergoing ECT further support its role in altering brain function at a fundamental level. The neurophysiological hypothesis, which focuses on the therapeutic induction of seizures, highlights the importance of electrical stimulation in affecting cerebral blood flow and metabolism changes, which correlate with clinical improvements. ECT's clinical efficacy is well-documented across a range of severe psychiatric conditions.

In cases of treatment-resistant depression, ECT has demonstrated response rates as high as 80-90%, significantly outperforming many pharmacological interventions. The American Psychiatric Association (APA) recommends ECT as an initial treatment option for severe depression, particularly when rapid symptom relief is required or when other treatments have failed. ECT is also effective in managing bipolar disorder, including its manic, depressive, and mixed states, with response rates around two-thirds in drug-resistant cases. Moreover, its utility in schizophrenia, especially for patients with limited response to antipsychotic medications, underscores its broader applicability in psychiatry. Despite its efficacy, the administration of ECT is not without risks. Cardiac complications, while relatively rare, can be severe, particularly in patients with preexisting cardiovascular conditions.

Careful monitoring and management of these patients are crucial to minimizing these risks. Anesthesia-related complications also pose challenges, emphasizing the need for skilled anesthetic management during ECT sessions. The debate over ECT's potential to cause epilepsy remains nuanced, with evidence suggesting that post-ECT seizures are more often associated with individual susceptibility rather than the treatment itself. This underscores the importance of comprehensive patient assessment and individualized treatment planning to mitigate such risks. In recent years, the FDA's reclassification of ECT devices from Class III (high risk) to Class II (moderate risk) reflects growing recognition of its safety and efficacy.

This regulatory change is a significant step towards integrating ECT more fully into mainstream psychiatric practice and improving patient access to this valuable treatment option. In conclusion, ECT represents a critical tool in the treatment of severe mental health disorders, offering hope to patients who have not responded to other therapies. Its evolving techniques and deepening understanding

of its mechanisms of action continue to enhance its efficacy and safety profile. Addressing the stigma and misconceptions surrounding ECT is vital for its acceptance and utilization in primary care, ensuring that more patients benefit from this life-changing treatment.

4. CONCLUSIONS

This article provides a comprehensive overview of electroconvulsive therapy (ECT), which can help practitioners address patient concerns. The therapy, despite its historical stigma, remains a relevant and effective psychiatric treatment for various mental health conditions. The article highlights the mechanism of action of ECT, including neurochemical and neurophysiological hypotheses, and emphasizes its indications and effectiveness in treating severe depression, bipolar disorder, and schizophrenia.

Moreover, the safety profile of ECT is still under discussion, acknowledging the transient cognitive adverse effects and the overall safety of the procedure, as recognized by regulatory authorities. The article also explores recent advancements in ECT techniques, such as high-dose unilateral ECT and brief pulse/ultra-brief pulse ECT, which offer promising alternatives with potentially fewer cognitive side effects. This article aims to provide general practitioners and clinicians with valuable insights into ECT, enabling them to understand its implications for clinical practice better and effectively address patient concerns.

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Authors' Contribution

Tymon Zatorski: Conceptualization, writing- rough preparation, editing
Dominika Kabała: Writing- rough preparation, methodology
Adam Jaskulski: Writing- review and editing,
Michał Bielecki: Methodology, supervision, investigation
Milena Szczepańska: Formal analysis, investigation
Marcin Głód: Conceptualization, supervision
Agata Zapałowska: Visualization, supervision
Project administration: Milena Szczepańska
All authors read and approved the final manuscript.

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Ethical approval

Not applicable.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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