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Editorial Letter

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# Semaglutide Use and Clinical Experience: Editorial Letter

Semaglutide has emerged in recent years as a prominent pharmaceutical agent used to treat Type 2 diabetes. Its mechanism of action is based on its role as a glucagon-like peptide-1 receptor agonist. A multicenter phase three study was conducted, in which 1,197 participants were observed over a period of 240 weeks. As indicated by the findings of the study, there was a substantial decline in the identification of steatohepatitis, concurrent with a notable decrease in body mass index among obese patients (1, 2).

Semaglutide has been associated with a variety of adverse effects, including gastrointestinal complaints, renal and biliary problems. Gastrointestinal adverse effects encompass a range of symptoms, including but not limited to: nausea, vomiting, abdominal pain, diarrhea, and constipation (3). In biliary pathologies, cholelithiasis and cholecystitis have been reported, and cases of pancreatitis are documented in the literature (4).

Dear Editor,It is worth noting that analogous observations have been made in the patients under our supervision. In the subsequent follow-up of patients using

semaglutide, a reduction in weight was observed, and the conditions of hepatosteatosis and steatohepatitis demonstrated regression. In addition to the observed decrease in body weight, it was noted that patients frequently exhibited gastrointestinal symptoms, particularly during the medication adaptation process.

Conversely, no significant adverse effects have been observed in patients exhibiting dyspeptic abdominal pain. However, subsequent patient monitoring has demonstrated that these adverse effects can lead to a decline in medication adherence and the cessation of weight loss after a certain duration. It is imperative that patients receive comprehensive information regarding any findings pertaining to the gastrointestinal system during subsequent follow-up appointments. In cases where such symptoms are present, it is imperative to provide supportive treatment and symptomatic relief.

**Keywords**: Semaglutide, Diabetes, Clinical Experience

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Acta Medica Young Doctors

Orginal Article

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# Mapping the Digital Visibility of Maladaptive Daydreaming: A Quantitative Analysis of YouTube Videos (2020–2025)

## ABSTRACT

**Background:** Maladaptive Daydreaming (MD) is a psychological phenomenon characterized by extensive fantasy activity that interferes with daily functioning. With the growing use of digital media for sharing personal experiences, YouTube has emerged as a major platform where individuals discuss mental health–related topics. However, the quantitative characteristics and visibility dynamics of MD-related content have not been systematically examined. This study aimed to analyze the trends, geographic distribution, and engagement metrics of YouTube videos related to Maladaptive Daydreaming between 2020 and 2025.

**Methods:** Publicly available metadata of YouTube videos containing the keyword “Maladaptive Daydreaming” were collected using the YouTube Data API (v3) via a custom Python-based script. After removing duplicate or incomplete entries, 525 videos were included in the final dataset. Descriptive statistics were computed, and non-normally distributed data were summarized as medians and interquartile ranges. Interaction Index and Viewing Rate were compared across years using Kruskal–Wallis tests, with statistical significance set at $p<0.05$.

**Results:** The number of MD-related videos increased substantially over the five-year period, from 35 in 2020 to 224 in 2025. Nearly half of the videos had undefined geographic origins (45.0%), while the United States (16.4%), the United Kingdom (9.3%), and India (6.9%) accounted for most identifiable content. Both Interaction Index ($H=26.65$, $p<0.001$) and Viewing Rate ($H=30.36$, p<0.001) significantly differed by year, peaking in 2024–2025.

**Conclusion:** The growing volume and engagement of MD-related content indicate an increasing public awareness and online discourse surrounding this psychological phenomenon. Future research should explore the thematic quality and emotional tone of such content to better understand its role in digital mental health narratives.

**Keywords:** Maladaptive Daydreaming, YouTube, Digital Mental Health, User Engagement, Online Awareness

## Introduction

Maladaptive daydreaming (MD) was first conceptualized by Somer (2002) as a clinical construct describing a phenomenon characterized by repetitive, immersive, and hard-to-control fantasy episodes that significantly impair an individual's daily functioning (1, 2). These episodes typically involve lengthy and detailed internal narrative flows, which, although voluntarily initiated, may progressively lead to a loss of control. During MD episodes, individuals often exhibit reduced responsiveness to external stimuli and enter a highly absorptive attentional state; rhythmic movements, walking, fidgeting, or auditory cues such as music can trigger or sustain the experience (3). Unlike normative daydreaming, MD is associated with marked functional impairments, including pronounced discontinuity, withdrawal from interpersonal relationships, disruption of academic and occupational duties, disturbed sleep patterns, and neglect of daily responsibilities (4). Some individuals report experiencing restlessness, irritability, and craving when attempting to suppress MD episodes, suggesting that the phenomenon may exhibit characteristics akin to behavioral addiction (5).

The developmental underpinnings of Maladaptive Daydreaming (MD) point to a multidimensional psychosocial framework. It has been suggested that the natural imaginative tendencies observed in early childhood may evolve into a pathological dependency on fantasy in certain individuals (4). Moreover, MD may function as an avoidance-oriented coping strategy that emerges in contexts of heightened interpersonal stress, loneliness, emotional deprivation, internal conflict, and anxiety (5). Interestingly, the absence of childhood trauma in a subset of individuals challenges strictly trauma-centered explanations of the phenomenon, underscoring the need to integrate psychodynamic, cognitive, and dissociative perspectives (6). The recurrent themes of idealization, empowerment, relational compensation, and emotional soothing within the fantasy narratives appear closely linked to the individual's unmet psychosocial needs (3).

From a clinical perspective, Maladaptive Daydreaming (MD) is characterized by a high comorbidity profile. Structured clinical interviews indicate that MD frequently co-occurs with attention-deficit/hyperactivity disorder (ADHD), obsessive–compulsive symptoms, anxiety disorders, depression, and dissociative experiences (2). In some cases, a diversity of internal characters, alternative self-representations, and dissociative phenomena have been observed, suggesting a potential associative link between MD and dissociative disorders (6). The absence of MD from major diagnostic systems such as the DSM and ICD continues to fuel debate regarding its nosological classification (3). This omission not only contributes to diagnostic ambiguity but also limits clinical recognition and the development of standardized assessment tools.

In recent years, public awareness of Maladaptive Daydreaming (MD) has rapidly increased across online platforms. Individuals experiencing MD have begun sharing their personal narratives through forums, social media communities, and particularly video-based content platforms (4). These digital narratives provide novel qualitative insights into fantasy themes, triggering stimuli, and individualized coping mechanisms. However, the accuracy, informational quality, and clinical applicability of user-generated content remain highly heterogeneous (3). Due to its user-driven production model, YouTube carries inherent risks of misinformation and popular misconceptions; nonetheless, the scholarly literature on systematic, quantitative, and metadata-based analyses of MD-related YouTube content remains extremely limited. Therefore, examining the temporal growth, user-engagement metrics, and geographic distribution of MD-related videos is crucial for understanding the phenomenon's digital visibility and evolving online representation.

## Materials And Methods

This study is a quantitative analysis examining the development and characteristics of YouTube content related to Maladaptive Daydreaming (MD) between 2020 and 2025. The primary data source consisted of publicly available metadata from videos on the YouTube platform containing the keyword "Maladaptive Daydreaming" within the specified time frame. This period was selected to provide a comprehensive and up-to-date analytical perspective, as it represents a critical phase during which public awareness of the topic markedly increased.

Data collection was conducted systematically using the YouTube Data API (v3). For this purpose, a custom Python script was developed and implemented. The main function of the script was to utilize the search and video detail services provided by the API to identify videos containing the keyword and extract relevant metadata. The data collection methodology was designed in accordance with the technical principles and best practices associated with the "YouTube Pneumothorax Scraper" framework (7). This technical infrastructure ensured compliance with API quota limits while guaranteeing that data retrieval was performed comprehensively, consistently, and in adherence to ethical standards. The retrieved metadata included key engagement metrics such as Video ID, Title, Description, Upload Date, Channel Information, View Count, Like Count, and Comment Count.

The raw dataset underwent extensive preprocessing to prepare it for analysis. Initially, the dataset was screened based on Video ID, and all duplicate records were removed to maintain data integrity. In addition, entries deemed irrelevant or insufficient for analysis—particularly those missing essential metadata such as video titles—were excluded. Subsequently, upload dates were converted into time-series compatible formats, and engagement metrics (views, likes, comments) were transformed into numerical data types suitable for statistical computation. Quantitative analyses focused on the annual distribution of videos between 2020 and 2025, as well as temporal trends in engagement metrics across years. Furthermore, content analysis of video titles and descriptions was conducted through frequency analysis to identify the main thematic trends and commonly used sub-keywords associated with Maladaptive Daydreaming.

**Ethical Issues**

The ethical framework of this research is based exclusively on the use of publicly accessible, aggregated, and anonymized metadata obtained through the YouTube Data API. No personally identifiable information (PII) belonging to any user was collected, analyzed, or stored at any stage of the research process. All procedures related to data collection and processing were conducted in full compliance with YouTube's Terms of Service and API Policies, ensuring that the study adhered to both ethical research standards and platform-specific data governance requirements.

**Statistical Analysis**

The data identified in the study were collected in a data form, analysed using SPSS version 27 (IBM Corp.) and plotted using GraphPad Prism. The data were classified. Categorical data were defined as percentages and frequencies. Numerical data were defined, and a distribution analysis was performed. Data that followed a normal distribution were defined as mean ± standard deviation (SD). For data that did not follow a normal distribution, the median and interquartile range (IQR) were used. Non-parametric tests were used to analyse non-normally distributed numerical data and to evaluate the relationship between groups using a post hoc test. Findings with a p-value below 0.05 were considered significant.

## RESULTS

The total number of videos identified in 2020 was 35, which progressively increased over the years, reaching 224 videos by 2025 (Figure 1). Examination of the 525 videos included in the dataset revealed that a substantial portion lacked identifiable geographic information, categorized as undefined (Un). This group accounted for approximately half of the dataset (n = 236, 45.0%). Among the videos with identifiable origins, the United States (US) ranked first with 86 videos (16.4%), followed by the United Kingdom (GB) with 49 videos (9.3%) and India (IN) with 36 videos (6.9%). These three countries represented the dominant contributors among those with defined locations. Other notable contributors included Italy (IT) with 17 videos (3.2%), Canada (CA) with 16 videos (3.0%), and the Philippines (PH) with 10 videos (1.9%). The remaining countries exhibited low frequencies (ranging from 1 to 8 videos), indicating that while the dataset had a global scope, it also demonstrated considerable heterogeneity. Cumulative percentages showed that approximately two-thirds (69.5%) of all videos—including the undefined group—originated from the United States, the United Kingdom, India, or the undefined category (Figure 2).

The median video duration was 347.50 seconds (IQR = 1009.0). Descriptive statistics are summarized in Table 1.

A Kruskal–Wallis test revealed a significant difference in Interaction Index values across years ($H = 26.65$, $p < 0.001$). Median (IQR) Interaction Index scores were 4.6 (4.02) in 2020, 4.52 (1.70) in 2021, 3.99 (1.85) in 2022, 4.47 (4.32) in 2023, 6.58 (4.49) in 2024, and 4.7 (5.91) in 2025 (Figure 3a).

Similarly, the Viewing Rate differed significantly across years ($H = 30.36$, $p < 0.001$). Median (IQR) values were 203.2 (307) in 2020, 129.6 (630) in 2021, 102.6 (979) in 2022, 65.04 (1019) in 2023, 330 (2127) in 2024, and 485.2 (3156) in 2025 (Figure 3b).

Table 1: Descriptive information

| Description | |
|---|---|
| Duration (Seconds) Median, IQR | 347,50 (1009,0) |
| Like Count Median, IQR | 24 (215,25) |
| Comment Count Median, IQR | 4 (33,25) |
| Days since upload Median, IQR | 469,5 (1009,5) |
| View count Median, IQR | 609,5 (4628,25) |
| Interaction index (%)Median, IQR | 4,7 (4,4) |
| Viewing rate (%)Median, IQR | 225,42 (1778,06) |

## Discussion

The primary aim of this study was to examine the quantitative characteristics and temporal evolution of YouTube content related to Maladaptive Daydreaming (MD) between 2020 and 2025. As mental health themes have become increasingly visible in digital environments, a systematic investigation of MD-related online content contributes to a deeper understanding of how this phenomenon manifests in terms of individual awareness, self-help practices, and online community formation. The findings demonstrated a substantial increase in the number of MD-related videos over the five-year period, with a marked rise in engagement levels (views and likes) particularly during 2024–2025. Furthermore, the majority of content originated from Anglophone countries such as the United States, the United Kingdom, and India, while a notable portion lacked identifiable geographic information. This pattern indicates that awareness of MD has achieved a form of global yet culturally diverse digital visibility. The significance of this study lies in its position as one of the first quantitative attempts to document how MD has transitioned from a clinical concept to a circulating discourse within the digital media ecosystem, where user-generated experiential narratives collectively construct a form of psychological community discourse.

The marked increase in Maladaptive Daydreaming (MD)–related videos observed between 2020 and 2025 reflects not only a rise in content production but also the growth of digital awareness and user engagement surrounding this phenomenon. Recent scholarship highlights that video-based platforms addressing mental health topics have evolved from being mere informational tools into interactive spaces where individuals share personal experiences and form communities within frameworks of self-diagnosis and self-help (e.g., 8). In this context, the increasing volume of MD-related videos suggests that users are transforming from passive viewers into active content creators, disseminating their experiences through algorithmically amplified recommendation systems to reach broader audiences. This trend also signals the expansion of mental health discourse into digital arenas, where user-driven and experiential forms of knowledge production are increasingly emerging beyond traditional academic or clinical domains. Thus, the growing number of videos represents not merely a quantitative increase but a broader cultural elevation of MD's online visibility, indicating its integration into the evolving landscape of digital mental health narratives.

The distribution of videos across countries indicates that MD-related content production demonstrates a predominantly Anglophone visibility, with a substantial portion of videos lacking identifiable geographic information. This pattern aligns with the historical conceptualization of MD within English-speaking contexts and the predominance of measurement equivalence studies conducted in these ecosystems. Cross-cultural research on the measurement invariance and meaning structures of MD suggests that while the disorder's core functional impairments appear consistent across cultures, its experiential interpretations and modes of expression are context-dependent—a finding that supports the notion of a partial language-mediated selection bias (9).

Moreover, recent studies have demonstrated that health-related content on YouTube suffers from representational limitations in terms of language and inclusivity, while the platform's algorithmic recommendation systems can generate structural biases that shape content diversity and visibility. Such mechanisms likely explain the relative prominence of English-language content, the high proportion of videos with undefined geographic origin, and the uneven regional distribution patterns (10). In addition, the dominance of English in health research and the presence of multilevel linguistic barriers systematically restrict the visibility of non-English content and creators, providing a structural explanation for the strong representation of the United States and the United Kingdom, as well as the large "undefined" category observed in this dataset (11). Finally, viewing and engagement patterns for online mental health content often intersect with geographic and linguistic inequalities; disparities in digital health access, connectivity, and media literacy across regions may shape both content production and consumption. Collectively, these findings suggest that the concentration and indeterminacy patterns identified in our results reflect the combined influence of platform-level (algorithmic), domain-level (linguistic and academic hegemony), and societal-level (digital inclusivity) factors.

Our analyses revealed a notable increase in the median Viewing Rate and Interaction Index in 2024 compared to all other years, suggesting not only an expansion in content volume but also a heightened level of user attention and engagement with MD-related videos. This finding aligns with the emerging literature on the attention economy, which posits that attention functions as an increasingly scarce resource within social media environments, while algorithmically structured content flows employ both psychological and technical mechanisms to enhance viewer engagement (12). Previous research has further shown that within health and mental health–related content, personal narratives and experiential sharing significantly increase user engagement (13).

In this context, the relatively higher engagement observed for MD-related content during 2024–2025 may indicate that both content creators and audiences developed a more sophisticated narrative strategy during this period, while platform algorithms potentially began favoring long-form or experience-centered videos in terms of visibility and recommendation. However, metrics such as views and likes capture only quantitative indicators of engagement and may not adequately reflect the quality or depth of user experience, as within the logic of the attention economy, "capturing attention" does not necessarily equate to "creating value" (14). Overall, these findings suggest that MD-related YouTube content has become increasingly appealing to viewers, yet this appeal is shaped by a complex interplay of factors, including content quality, algorithmic amplification, and user motivations.

The findings of this study indicate that YouTube functions not only as a platform for information exchange but also as a space for the expression and interpretation of psychological experiences. Interpreted through the lens of the Uses and Gratifications Theory (15), this pattern suggests that individuals use the platform to attain both cognitive and emotional gratifications. The increase in viewership and engagement with MD-related videos implies that users derive forms of emotional support, informational validation, and identification from such content. Similarly, within the framework of Parasocial Interaction Theory, the one-sided yet psychologically meaningful relationships established between viewers and content creators play a pivotal role in fostering social validation and visibility of MD experiences (16).

The personal narrative format that YouTube enables allows individuals to externalize their internal experiences into the public domain, thereby reinforcing self-representation processes (17). This trend aligns with recent findings showing that mental health themes are increasingly manifested as digital self-narratives in online spaces (18). Consequently, the quantitative growth of MD-related content reflects not only users' pursuit of knowledge but also a broader digital transformation in how individuals construct identity, seek social belonging, and cultivate psychological resilience through mediated interaction.

This study entails several methodological and conceptual limitations. First, it relies exclusively on publicly available and anonymized metadata accessed through the YouTube Data API; therefore, the content quality, narrative style, and emotional tone of the videos could not be directly analyzed. Consequently, engagement metrics (e.g., views, likes, comments) were evaluated solely as quantitative indicators, leaving the emotional and interpretive dimensions of user experience unexplored. Second, data collection was conducted using English-language keywords, introducing potential linguistic bias and limitations in cultural representation. The exclusion of non-English content may have restricted the ability to capture the full global diversity of the MD phenomenon.

Additionally, YouTube's algorithmic visibility policies may have influenced which videos were recommended more frequently and, thus, which were included in the dataset. Such algorithmic selection biases are increasingly recognized as a systematic limitation in digital media research (19). Future studies could address these issues through multi-platform comparisons (e.g., TikTok, Reddit, Instagram), emotional content analysis, comment-based sentiment mining, and time-series modeling, to explore the qualitative aspects of MD's digital visibility in greater depth. Moreover, future research should examine how users identify with these contents, construct digital identity narratives, and engage in online support communities through mixed-method designs. Such approaches would illuminate not only the quantity but also the meaningful dimensions of digital experience, thereby providing a more comprehensive understanding of the psychosocial context surrounding the online representation of MD.

**Limitations**

This study has certain limitations that arise from the methodological and data collection processes. Firstly, the research findings are based exclusively on publicly available, anonymous metadata accessed via the YouTube Data API. This approach meant that qualitative aspects such as the quality of the video content, narrative style and emotional tone could not be analysed directly. Consequently, interaction metrics such as views and likes could only be evaluated as quantitative indicators, and it was not possible to explore the emotional and interpretative dimensions of the user experience. Secondly, using only English keywords in the data collection process created a potential linguistic bias, limiting the ability to reflect the global diversity of the Maladaptive Daydreaming (MD) phenomenon fully. Thirdly, YouTube's algorithmic visibility policies may have influenced which videos were recommended more frequently and thus included in the dataset, pointing to algorithmic selection bias, a recognised systematic limitation in digital media research.

## Conclusion

The increasing volume and level of interaction clearly demonstrate growing public awareness and online discourse regarding MD. Future research should analyse the themes and emotional tone of this content to better understand its role in digital mental health narratives.

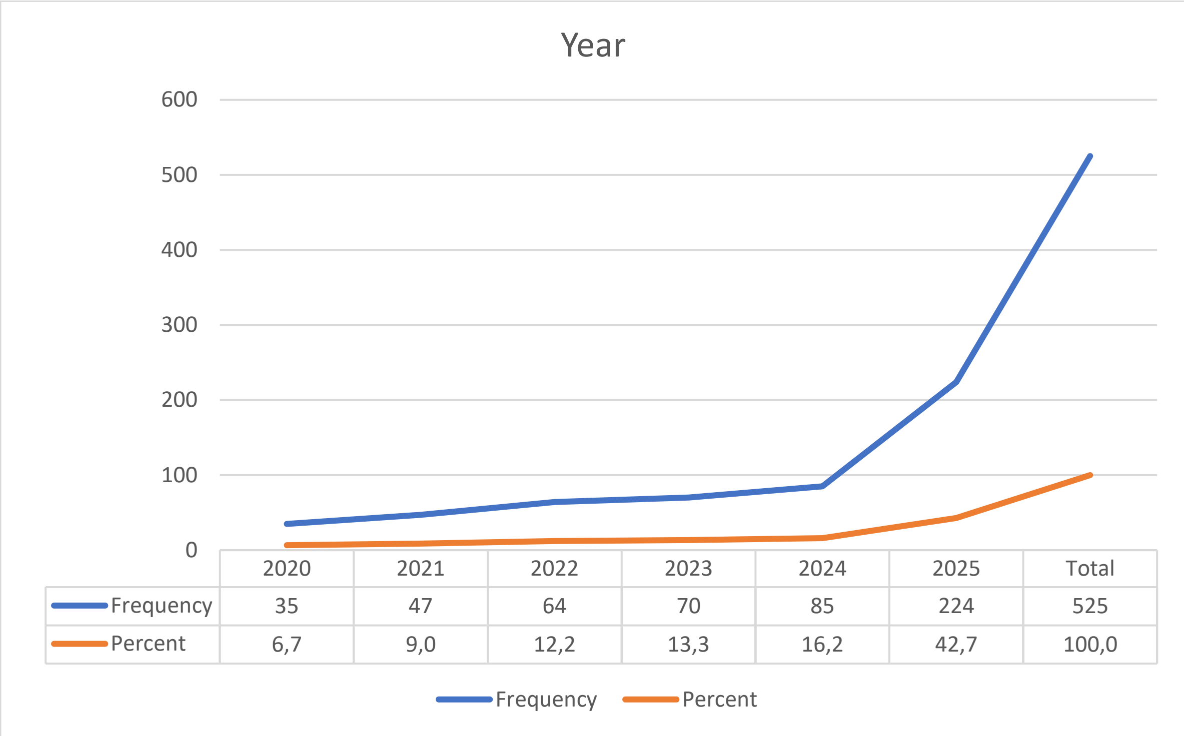


Figure 1: Number of videos by year

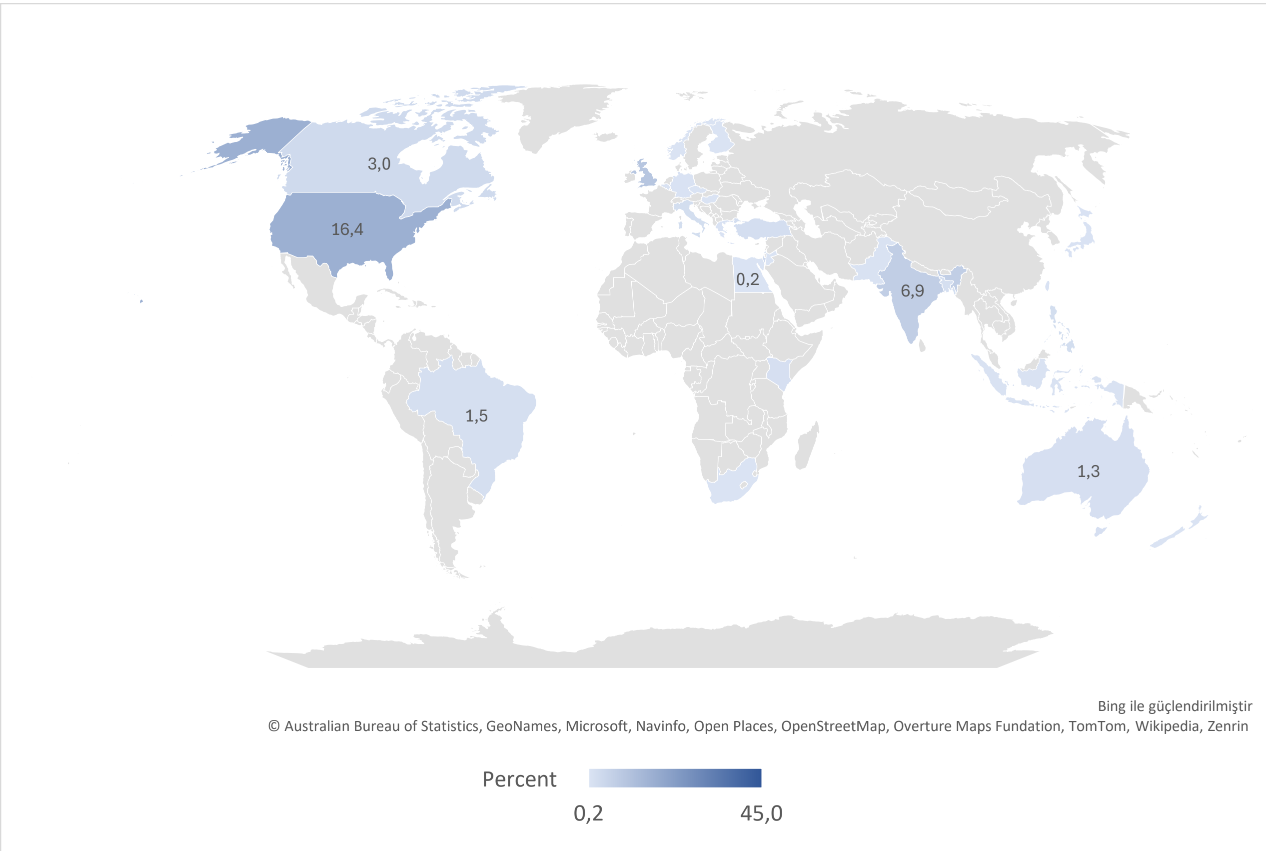


Figure 2: Number of videos by country

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Acta Medica Young Doctors

Orginal Article

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# An Emergency Service Example During the Pandemic: Bandırma

## ABSTRACT

**Background:** The ongoing global pandemic has underscored the pressing need to comprehend the long-term ramifications of the condition on those who have survived, with a particular emphasis on respiratory health. The present study investigates the association between a history of infection with the SARS-CoV-2 virus and the outcome of a subsequent acute respiratory disease in hospitalized patients, with the objective of elucidating the long-term respiratory implications of the disease.

**Methods:** The present retrospective study analyzed data from 394 patients admitted to the emergency department with acute respiratory conditions and hospitalized between November 2022 and March 2023. The data set included demographics, comorbidities, and history of SARS-CoV-2 infection, as well as the primary outcome data (death or intensive care unit admission).

**Results:** Among 394 patients, a history of infection with the novel coronavirus was associated with a significant increase in adverse outcomes, including death or admission to the intensive care unit. The risk exhibited variation according to the severity of the preceding infection; patients receiving ICU treatment exhibited a higher risk, while those treated in wards exhibited a lower risk. Multivariate analysis identified diabetes, Alzheimer's disease and dementia, and ICU treatment for previous severe acute respiratory syndrome as significant predictors of adverse outcomes, while benign prostatic hyperplasia (BPH) and ward treatment emerged as protective factors.

**Conclusions:** The findings emphasize the significance of customized post-discharge care and underscore the necessity for ongoing research to elucidate the long-term ramifications of the novel coronavirus, thereby facilitating more effective clinical management and enhancing patient outcomes.

**Keywords**: COVID, Emergency Medicine, Outcome

## Introduction

The ongoing global pandemic of the novel coronavirus, officially designated as SARS-CoV-2, is primarily characterized as an acute respiratory illness. This virus has resulted in millions of deaths and significant morbidity worldwide, despite the rapid introduction of highly effective vaccines (1).

While a considerable proportion of patients have experienced complete recovery following the acute phase of the illness, a significant subset has continued to manifest symptoms for an extended period. Furthermore, it has been observed that the disease may result in lasting damage beyond the post-acute phase, leading to the definition of "post-covid-19 syndrome (PCS)" or "long-covid-19." The prevalence of this condition is estimated to be between 10% and 25% even in outpatient settings, and potentially higher among hospitalized patients (2).

It has been observed that a significant proportion of patients continue to experience symptoms of the novel coronavirus for a period of time extending beyond six months following the onset of the infection. A study of 2,000 individuals revealed that approximately two-thirds of patients exhibited at least one symptom, such as fatigue or respiratory distress, and nearly half of them still reported symptoms during the first year (3). Additionally, impairments have been observed in tests such as walking tests and pulmonary diffusion capacity at the three-month mark (4). The presence of cardiopulmonary damage and functional deficits has been associated with the novel coronavirus. While a number of mechanisms related to the prolonged effects of the novel coronavirus (SARS-CoV-2) have been proposed, including virus-related organ damage, persistent inflammation, immune dysregulation, and hypercoagulability, the exact mechanisms remain unclear (7,8). Furthermore, knowledge regarding long-term cardiopulmonary disorders and their consequences in individuals who have recovered from the disease is limited.

The long-term implications of the novel virus remain uncertain, as the current data do not allow for determination of whether mortality rates will increase in the long term due to underlying chronic lung disease or the development of new acute lung conditions. This information has the potential to influence clinical management and the significance of a history of prior infection with the virus.

The objective of this study is to examine the association between the course of acute respiratory disease and the history of prior infection with the novel coronavirus, SARS-CoV-2, in patients presenting to the emergency department with acute respiratory illness and requiring hospitalization.

## Methods

### Patients

In this retrospective study, a total of 120,747 patients who were admitted to the emergency care unit between November 2022 and March 2023 were screened, and 394 eligible patients were included in the study. Patients who admitted to an acute pulmonary condition as their primary ailment and were ultimately hospitalized for this condition were included in the study. Furthermore, to qualify, patients had to be at least 18 years of age, and their data concerning previous cases of COVD had to be both available and accessible. A subsequent analysis of the hospital records of the patients was conducted, and the relevant study data were retrieved. The study's inclusion criteria were limited to hospitalized patients, excluding those receiving outpatient care. Patients who were admitted to the hospital for reasons unrelated to a non-pulmonary condition, as well as those with inadequate data regarding their history of severe acute respiratory syndrome (SARS-CoV-2) on their hospital records, were excluded from the study. The study protocol was approved by the local ethics committee, and the study was conducted in accordance with the Declaration of Helsinki.

**Data extraction**

A review of existing records was conducted to ascertain hospitalization data and previous history of SARS-CoV-2 infection. The following data were collected: the primary indication for hospitalization (pulmonary condition), co-morbid conditions, and demographic data, in addition to the study outcomes (death and intensive care unit admission). A review of the extant literature was conducted to ascertain the previous history of the novel pathogen. Patients who were admitted to the hospital with respiratory conditions associated with the novel coronavirus (SARS-CoV-2) were also included in the study, along with their medical history, including previous cases of SARS-CoV-2 infection. The combined study endpoint was defined as death (in-hospital death within 30 days of hospitalization) and/or ICU admission. All subsequent analyses were conducted with this endpoint in mind.

**Statistical analysis**

The analysis of the data was conducted using IBM SPSS Statistics version 21.0 software. The descriptive data are presented in number (percentage) or mean ± standard deviation. Between-group comparisons of categorical variables were conducted using the chi-square test or Fisher's exact test, as appropriate. The Student's t-test for independent samples was employed to facilitate the comparison of continuous variables. Receiver operating characteristic (ROC) curves were generated to identify optimal cut-off points for predicting combined endpoints using the highest Youden Index (sensitivity + specificity - 1). A stepwise logistic regression model was employed to identify the significant independent predictors of the combined endpoint. A p-value greater than 0.05 was considered to be indicative of statistical significance.

## Results

**Patients**

The present study encompassed a total of 394 eligible patients. As illustrated in Table 1, the initial demographic and clinical characteristics of the patient population are presented, along with the subgroup that has a documented history of prior infection with the SARS-CoV-2 virus. This determination is based on a comprehensive review of the patients' medical histories and electronic health records. The most prevalent indication for admission was pneumonia (54.6%), followed by new cases of severe acute respiratory syndrome (SARS) (18.0%) and exacerbations of chronic obstructive pulmonary disease (COPD) (17.3%). The analysis revealed that the majority of the patients (81.7%) exhibited at least one comorbid condition. Approximately 25% of patients had a documented history of prior infection with the virus. As illustrated in Table 2, the most prevalent comorbid conditions were hypertension (34.3%), followed by coronary artery disease (28.4%), chronic obstructive pulmonary disease (24.6%), and diabetes (17.8%). Among patients with a documented history of infection with the SARS-CoV-2 virus, the mean time between the initial infection and the most recent admission was more than one year (450.0 ± 217.1 days; range, 56–937 days).

Table 1. Baseline demographical and clinical characteristics of the patients

| Factors | n=394 |
|---|---|
| Age, years (mean±SD) | 75.6±12.9 |
| Male sex | 248 (63.2%) |
| Comorbid condition present | 322 (81.7%) |
| Pulmonary hospitalization indication (at present) | |
| Pneumonia | 215 (54.6%) |
| COVID | 71 (18.0%) |
| COPD attack | 68 (17.3%) |
| Pulmonary embolism | 17 (4.3%) |
| Asthma | 7 (1.8%) |
| Smoke exposure | 7 (1.8%) |
| Pulmonary edema | 6 (1.5%) |
| Pleural effusion | 3 (0.8%) |
| Previous COVID history present | 104 (26.4%) |
| Multiple COVID infection† | 12 (11.5%) |
| Time from COVID infection, days (mean±SD)†* | 450.0±217.1 |
| Hospitalization requirement during COVID† | |
| No hospitalization, at home | 6 (5.8%) |
| Hospitalization, at wards | 77 (74.0%) |
| ICU admission | 21 (20.2%) |

Unless otherwise stated, data presented in number (percentage). †Percentage of the COVID related factors represents the ratios among patients with COVID infection history. ICU, intensive care unit. *If multiple, time from the first COVID infection

Table 2. Comorbidities present at the time of admission

| Comorbidity | n=394 |
|---|---|
| No comorbidity | 72 (18.3%) |
| Multiple comorbidity | 195 (49.5%) |
| Hypertension | 135 (34.3%) |
| Coronary artery disease | 112 (28.4%) |
| Chronic obstructive pulmonary disease | 97 (24.6%) |
| Diabetes | 70 (17.8%) |
| Malignancy | 40 (10.2%) |
| Cerebrovascular accident (previous) | 39 (9.9%) |
| Benign prostate hyperplasia | 33 (8.4%) |
| Asthma | 23 (5.8%) |
| Alzheimer/Dementia | 19 (4.8%) |
| Congestive heart failure | 19 (4.8%) |
| Chronic renal failure | 10 (2.5%) |
| Epilepsy | 3 (0.8%) |
| Other* | 22 (5.6%) |

Data presented in number (percentage)
*Other comorbidities include tuberculosis, interstitial lung disease, lung fibrosis, bronchiectasis, peripheral vascular disease, heart transplantation, Parkinson's disease, mental retardation, down syndrome, romatoid arthritis, ulcerative collitis

**Factors affecting combined endpoint (death or ICU admission)**

A previous history of SARS-CoV-2 infection was found to be associated with a significant association with the development of the combined endpoint (p = 0.024). However, two subgroups exhibited relationships with opposite directions. Specifically, a history of previous SARS-CoV-2 infection treated in a hospital ward was associated with a smaller risk for the combined endpoint. Conversely, a history of previous SARS-CoV-2 infection treated in the intensive care unit (ICU) was associated with a higher risk (Table 3). As illustrated in Table 3, a univariate and multivariate analysis of factors that may affect the combined endpoint is presented. Furthermore, univariate analysis revealed that advanced age, female gender, a high number of comorbid conditions, and three comorbid conditions (cerebrovascular accident, diabetes, and Alzheimer/dementia) were associated with a higher risk of the combined endpoint. Conversely, benign prostate hyperplasia and an indication for the latest admission (smoke exposure) were associated with a lower risk. The results of the study indicate that no other factors that were tested were associated with the combined endpoint risk, including other comorbidities (see Table 2). These results remained consistent across all other indicators, including other indications for the latest admission, time from the most recent infection with SARS-CoV-2, history of multiple infections with SARS-CoV-2, and previous infections with SARS-CoV-2 treated at home. Multivariate analysis identified diabetes (odds ratio [OR]: 2.3), Alzheimer's disease and dementia (OR: 10.9), and intensive care unit (ICU) treatment for the previous severe acute respiratory syndrome (SARS)-CoV-2 infection (OR: 3.8) as significant independent predictors of increased risk for the combined endpoint (Table 3). Conversely, benign prostate hyperplasia (OR: 0.2) and hospital ward treatment for the previous COVIID injection (OR: 0.2) emerged as significant independent predictors of a lower risk of the combined endpoint (Table 3).

## Discussion

The consequences of the novel coronavirus disease (NCD) 2019, persisting well beyond the acute phase of recovery, pose a multifaceted challenge to healthcare systems globally (9). The present study aimed to examine the relationship between acute respiratory disease outcomes and a previous history of NCD, with a particular focus on hospitalized individuals. The investigation's significance is underscored by the mounting recognition of the novel coronavirus not solely as a severe acute illness but also as a condition with the potential to manifest chronic health implications, particularly in the respiratory system. To the best of our knowledge, this is the first study examining the effect of the history of SARS-CoV-2 infection on the outcome of acute respiratory conditions later in life.

The findings of the present study indicate a pronounced association between previous infection with the novel coronavirus and an increased risk of adverse respiratory outcomes, including death or admission to the intensive care unit (ICU), among individuals hospitalized for acute respiratory conditions. This finding is consistent with the emerging body of literature on post-acute sequelae of the disease, which suggests that individuals who have recovered from a bout of severe acute respiratory syndrome (SARS-CoV-2) may experience persistent health issues, including respiratory dysfunction. For instance, studies have reported long-term pulmonary abnormalities post-covid, ranging from reduced diffusion capacity to the manifestation of fibrotic changes, which may explain the unfavorable outcomes found in the present study in association with the history of disease, particularly after a severe attack (3, 10, 11).

The present study offers insights into the differential impact of the severity of the novel coronavirus on long-term respiratory health by delineating outcomes based on the level of care (wards vs. intensive care unit [ICU]). Severe cases of the novel coronavirus disease (NCD) have been observed to result in acute respiratory distress syndrome (ARDS), which can lead to significant pulmonary fibrosis and chronic lung disease, often requiring intensive care unit (ICU) admission (12). In contrast, patients with less severe NCDs who receive treatment in wards may not experience the same extent of structural lung damage, potentially resulting in enhanced long-term pulmonary functionality. This discrepancy in findings between the two groups, those treated in the wards and those treated in the ICU, may offer insight into the differential outcomes observed in the present study. A multitude of studies have reported findings that are consistent with this hypothesis, suggesting that patients with severe cases of the disease may experience more severe pulmonary consequences, while those with less severe cases may experience relatively milder consequences. A recent study by Huang et al. examined the long-term effects of mild to moderate but not severe cases of SARS-CoV-2 infection in hospitalized patients. The study found that patients exhibited persistent symptoms six months after initial infection, with no significant impact on long-term pulmonary function (13). As indicated by the findings of a systematic review and meta-analysis of long-term physical and mental sequelae of the novel coronavirus disease (nCoV-19), patients with severe acute infections exhibited impaired pulmonary diffusion capacities and abnormal chest imaging manifestations at six months (14). The review identified more severe status at the time of acute infection as a risk factor for long-term sequelae. Fifteen: In a long-term respiratory follow-up of ICU-hospitalized patients with confirmed cases of severe acute respiratory syndrome (SARS) caused by the novel coronavirus (nCoV), the presence of respiratory alterations was still evident six to twelve months after hospital admission. The following factors were identified as risk factors for the development of structural lesions: male sex, prolonged ICU stay, and prolonged intermittent mandatory ventilation (15, 16). Similarly, several other studies have supported the possible relation between the severity of acute SARS disease and the severity of pulmonary sequelae (17, 18).

Conversely, for patients with less severe disease, the hospitalization period may present a unique opportunity for healthcare providers to identify and manage pre-existing or co-morbid pulmonary conditions that may be exacerbated by the novel virus. This early intervention has the potential to yield enhanced respiratory outcomes for patients treated in wards, as opposed to those with severe disease managed in the ICU, where the emphasis is frequently on acute survival rather than long-term health optimization. This observation may offer a partial explanation for the observed improvement in acute respiratory disease outcomes among patients treated in non-ICU wards.

The recommendation for a structured, multidisciplinary approach to post-discharge care of COVID-19 survivors seems to be of great importance. Regular monitoring, especially of lung function and rehabilitation needs, would be essential for identifying and addressing long-term sequelae; in addition, conducting longitudinal studies and analyzing registries to better understand and manage the chronic impacts of COVID-19 on respiratory health would be of great help (19-21). Moreover, the importance of early intervention and identification of co-morbid conditions during hospitalization cannot be overstated. Furthermore, the integration of multidisciplinary rehabilitation programs could play a crucial role in addressing the broad spectrum of long-term effects associated with COVID-19, leading to a better recovery process for affected individuals.

The limitations of this study, notably its retrospective design and the reliance on hospital records, highlight the need for further prospective and longitudinal research. Such studies would provide more definitive insights into the causal relationships between COVID-19 and long-term respiratory outcomes and help identify effective interventions to mitigate these effects.

In summary, the present study contributes to the growing body of evidence regarding the long-term respiratory implications of the novel coronavirus disease (NCD) caused by severe acute respiratory syndrome (SARS) CoV-2. The differential outcomes observed between patients treated in wards versus those in ICUs underscore the need for targeted post-discharge strategies tailored to the severity of the initial illness. As we persist in our navigation of the long-term repercussions of the novel coronavirus disease (NCD) pandemic, it is imperative to concentrate on two primary aspects: acute management and long-term rehabilitation. This dual approach is instrumental in maximizing respiratory health outcomes in survivors.

Table 3. Univariate and multivariate analysis of factors that may affect combined end point (death or ICU admission (n=394)

| **Parameter** | **No death or ICU admission (n=248)** | **Death or ICU admission (n=146)** | **Univariate p** | **Multivariate OR (95% CI), p** |
|---|---|---|---|---|
| Age | | | | |
| <73 y | 128 (68.4%) | 59 (31.6%) | 0.032 | |
| ≥73 y | 120 (58.0%) | 87 (42.0%) | | |
| Sex | | | | |
| Male | 166 (66.7%) | 83 (33.3%) | 0.045 | |
| Female | 82 (56.6%) | 63 (43.4%) | | |
| Comorbidities (n) | | | | |
| <3 | 208 (66.5%) | 105 (33.5%) | 0.005 | |
| ≥3 | 40 (49.4%) | 41 (50.6%) | | |
| Comorbidity - CVA | | | | |
| Absent | 230 (64.8%) | 125 (35.2%) | 0.022 | |
| Present | 18 (46.2%) | 21 (53.8%) | | |
| Comorbidity - Diabetes | | | | |
| Absent | 216 (66.7%) | 108 (33.3%) | 0.001 | **2.3 (1.2-4.4), 0.013** |
| Present | 32 (45.7%) | 38 (54.3%) | | |
| Comorbidity - BPH | | | | |
| Absent | 222 (61.5%) | 139 (38.5%) | 0.049 | **0.2 (0.1-0.7), 0.006** |
| Present | 26 (78.8%) | 7 (21.2%) | | |
| Comorbidity – Alzheimer/Dementia | | | | |
| Absent | 245 (65.3%) | 130 (34.7%) | <0.001 | **10.9 (2.3-52.8), 0.003** |
| Present | 3 (15.8%) | 16 (84.2%) | | |
| Previous COVID - treatment at hospital wards | | | | |
| No | 182 (57.4%) | 135 (42.6%) | <0.001 | **0.2 (0.1-0.4), <0.001** |
| Yes | 66 (85.7%) | 11 (14.3%) | | |
| Previous COVID - treatment at ICU | | | | |
| No | 242 (64.9%) | 131 (35.1%) | 0.001 | **3.8 (1.3-10.9), 0.013** |
| Yes | 6 (28.6%) | 15 (71.4%) | | |
| Indication for latest hospitalization - COVID | | | | |
| No | 210 (65.0%) | 113 (35.0%) | 0.069 | |
| Yes | 38 (53.5%) | 33 (46.5%) | | |
| Indication for latest hospitalization – Smoke exposure | | | | |
| No | 241 (62.3%) | 146 (37.7%) | 0.038 | |
| Yes | 7 (100.0%) | 0 (0.0%) | | |

Unless otherwise stated, data presented as n (%). Abbreviations: CVA, cerebrovascular accident; BPH, benign prostate hyperplasia, OR, odds ratio; CI, confidence interval. Odds ratios are in reference to the first row

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Acta Medica Young Doctors

Case Report

# Acneiform Eruption Due To Erlotinib Treatment: A Case Report

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## ABSTRACT

**Objective:** Cutaneous leishmaniasis (CL) is a climate-sensitive disease; changes in temperature, precipitation, and humidity levels can affect sandflies and reservoir hosts by altering their distribution, survival time, and population size. This article elaborates on the diagnostic challenges, treatment process and follow-up of a series of cutaneous leishmaniasis cases.

**Cases:** This case series comprises a total of six distinct cases of cutaneous leishmaniasis referred to our institution. Three of the individuals were female and four were male. The patients were diagnosed via Polymerase Chain Reaction *(PCR)*, punch biopsy, PAS/EZN staining, and blood smear. Glucantime treatment was initiated in all patients. Our institution has granted ethics committee approval, and informed consent was obtained from all participants.

**Conclusion:** Although the microorganism responsible for leishmaniasis has been identified for over a century, the disease remains a significant public health concern in many countries, particularly in developing nations. It ranks second in importance after malaria among parasitic diseases due to the difficulty of both treatment and control. In recent years, patients diagnosed with cutaneous leishmaniasis among refugees migrating from Syria to our country have caused an

increase in the disease in our country and affected epidemiological data.

**Keywords:** *Cutaneous Leishmaniasis, Glucantime, Endemic, Refugees, Protozoan Microorganisms*

## Introduction

Leishmaniasis is a disease complex caused by protozoan microorganisms of Leishmania and transmitted through the bite of the female sand fly *(midges)*. Humans, dogs, and rodents serve as reservoir hosts for various Leishmania species, depending on the host's immune response and the specific Leishmania species involved. Infection results in cutaneous, mucocutaneous, or visceral disease (1). Although the microorganism responsible for leishmaniasis has been identified for over a century, the disease remains a significant public health concern in many countries, particularly in developing nations. It ranks second in importance after malaria among parasitic diseases due to the difficulty of both treatment and control (2).

The majority of patients cannot benefit from diagnosis and treatment opportunities due to poverty and living in rural areas. Turkey is one of the countries where cutaneous leishmaniasis *(CL)* is endemic. CL is still a significant public health problem in the region where Turkey is located, especially in its neighbours such as Iran and Syria. The refugees who have fled the war in Syria and taken refuge in our country, the number of which exceeds 2 million, pose the risk of many infectious diseases, especially CL, being carried to our country (3).

The fact that the lesions are painless, can heal spontaneously without leaving scars in about a year, and do not cause systemic complications or death has led to the acceptance of the disease by society. However, it causes social and psychological problems such as depression, anxiety, and decreased quality of life in those with active lesions or scars. Current treatments for leishmaniasis are far from ideal. Leishmaniasis is one of the most neglected diseases in terms of drug development and discovery. Most of the current antileishmanial drugs are highly toxic, have resistance problems, and require hospitalisation for systemic treatment (4).

The distribution and spread of the disease is related to economic status, behaviour and environmental changes. New settlements, settlements in forest areas, destruction of forests, migration from rural areas to cities, rapid and unplanned urbanization, increase in dog and rodent populations, decrease in insecticide use, increase in the number of immunosuppressed hosts, construction of dams, new irrigation projects, migrations due to various reasons, especially war and natural disasters, play an essential role in the spread of the disease. It is believed that the population of vector organisms will increase due to the effects of global warming and related climate changes, and their breeding and living areas will expand from sea level to higher altitudes and northern latitudes (5).

CL is a climate-sensitive disease; changes in temperature, precipitation, and humidity levels can affect sandflies and reservoir hosts by altering their distribution, survival time, and population size. The formation of slums in areas where rodent reservoir hosts are densely located as a result of unplanned urbanisation and migration to cities has caused an increase in the incidence of leishmaniasis in these areas (6). This article elaborates on the diagnostic challenges, treatment process and follow-up of a series of cutaneous leishmaniasis cases.

## CASES

### CASE 1

A 40-year-old female patient applied to our outpatient clinic with a wound on her left hand for 2 months. The patient stated that when the wound on her hand first appeared, it was like a red pimple, and that the wound deepened after using a cream containing the active ingredient nitrofurazone on the wound for 1 month.

The patient lives in the Reyhanlı district of Hatay province. She did not describe any history of fly bites, but stated that she works in the garden seasonally in the spring and fall. No one else in the house has a similar wound. She has no prior experience in animal husbandry.

In the dermatological examination performed on the patient, there was a 10x4 cm area on the dorsum of the left hand with irregular borders, peripheral erythema, indurated middle, exudative appearance, yellow-white discharge on the edges of the lesion, and a painless, ulcerated lesion on palpation.

The patient was followed up at the external centre in January 2025 with a preliminary diagnosis of pyoderma gangrenosum. When no response was obtained from multiple antibiotics, the patient was referred for further evaluation, potentially for contact dermatitis or pyoderma gangrenosum. A punch biopsy was taken with the preliminary diagnosis of ecthyma gangrenosum—atypical mycobacterial infection. In the histopathology report, Epidermis was not observed in the sections. Mononuclear inflammation extending to the fatty tissue in the dermis; lymphohistiocytic infiltration in the intima of a medium-sized venule and related luminal narrowing, fibrin thrombus in the lumen and sparse, interstitial non-necrotic granuloma are observed.

An ulceration was observed on the dorsum of the left hand, characterised by dermal venous obliteration and lymphohistiocytic infiltration. During the biopsy, epidermis was not observed due to ulceration. Pyoderma gangrenosum *(granulomatous type)* and granulomatous dermatitis, primarily mycobacterial infection, were included in the differential diagnosis. Fungal hyphae/spores were not detected with PAS. No acid-fast bacilli were seen in EZN staining.

Although the current findings were nonspecific, they can also be observed in pyoderma gangrenosum. Although no infectious agent was detected histochemically, the possibility of pyoderma gangrenosum cannot be definitively ruled out at the histopathological level.

Infectious disease was not contagious, and TMP-SMX 800/125 mg was initiated on 02.14.25 with a dosage of 2:1. To exclude the diagnosis of lupus vulgaris, the patient underwent an interferon gamma release test, with a negative result reported.

The diagnosis of leishmania could not be excluded in the patient's current history, and a wound culture and a leishmania smear sample were taken from the ulcerated, discharged lesion on the dorsum of the left hand. There was no growth in the wound culture. Kinetoplasts were observed in the smear, as indicated by the positive polymerase chain reaction *(PCR)* examination from the lesion, which confirmed the presence of Leishmania.


**Figure 1:** *Leishmaniasis lesions (A) Before treatment, (B) After treatment*

The patient was admitted to the ward, and intramuscular Glucantime treatment was initiated. The patient weighed 70 kg and received treatment with 12 mL of Glucantime every 12 hours, consisting of 1.5 ampules in the morning and one ampule in the evening, for 21 days. Daily vital signs, myalgia, and daily ECG monitoring were followed for 3 days, and the patient's blood tests were within normal reference values. No side effects were observed. Mupirocin cream was applied to the ulcerated area within the lesion, mometasone furoate and fusidic acid were applied to the erythematous area at the periphery of the lesion, and the wound dressing was renewed daily. After 21 days of treatment, the patient was discharged with a full recovery, having experienced regression of the lesion.

## CASE 2

A 45-year-old male patient applied to our clinic with a complaint of a wound on his right hand for 1 year. The patient reported that the wound on his hand initially resembled a red pimple but had spread and gradually deepened within one year.

The patient lived in the Altınözü district of Hatay province. He did not describe a history of fly bites. No one else in the house has a similar wound. He had no prior experience in animal husbandry. The patient's anamnesis revealed that he regularly does gardening.

In the dermatological examination, there was an ulcerated lesion with irregular borders, widespread erythema on the base, no exudative or purulent discharge, and painless on palpation, in a 5x2 cm area on the dorsum of his right hand.

According to the patient's medical history, the patient was treated with topical nitrofurazone, clobetasol propionate, mupirocin, and sertaconazole nitrate in different centres over the last year for the existing lesion. Since he was unresponsive to these topicals, systemic terbinafine was started 2 days ago at a dosage of 250 mg/g. All systemic and topical treatments initiated at external centres were discontinued, and native and Leishmania smear samples were taken 1 week later.

The patient was diagnosed with leishmaniasis after the leishmania blood smear result came back positive. It was reported. Intralesional glucantime treatment was initiated once a week. After 10 sessions of intralesional glucantime treatment using the papule formation technique, with lesions treated from the periphery to the centre at 1 cm intervals until the entire lesion turned white, the ulcerated lesion on the right hand regressed.

**Figure 2:** *The wound on the right hand of the patient*

***CASE 3***

A 42-year-old male patient applied to our outpatient clinic with a wound on his right cheek for 4 months. The patient stated that the wound on his right cheek started as a pimple-like lesion 4 months ago and gradually deepened in the last 2 months, and turned into its current appearance.

The patient lives in the Altınözü district of Hatay province. He did not describe a history of fly bites. No one else in the house had a similar wound. He had no prior experience in animal husbandry. The patient's anamnesis revealed that he did not do gardening.

In the dermatological examination, there was a 2.5 cm diameter ulcerated lesion with irregular borders and erythema on the right malar region, with widespread erythema and oedema in the periphery, with black-brown crusting, painless on palpation, non-fluctuating, and discharged. Dermoscopy revealed pinpoint haemorrhage foci on globular structures, yellow-black discolouration and crusting containing keratin cysts.

According to the anamnesis taken from the patient, when the ulcerated lesion was applied to an external centre, it was learned that he received systemic cefuroxime axetil 1.5 g per day for 1 week, topical mupirocin and fucidic acid, and intralesional clindamycin treatments, and that he was unresponsive to these treatments.

A wound culture was taken from the patient's ulcerated lesion with discharge. The superficial tissue ultrasonography examined from the current lesion was reported as 'In the superficial B-mode examination of the clinically described region, a loculation area measuring 10x8.5 mm in size, heterogeneous hypoechoic internal structure, which cannot be clearly distinguished from the surrounding tissue and did not show vascular flow coding, was noted.

It was recommended that the patient be evaluated together with clinical and laboratory findings.' A smear sample was taken from the patient, who used systemic amoxicillin clavulanate 2 g/day for 10 days, with a preliminary diagnosis of leishmania at the control visit 10 days later. A widespread kinetoplast was seen as a result of the smear. The Leishmania smear was positive.

The patient was treated with five sessions of glucantime treatment using the papule formation technique, with 1 cm intervals from the periphery of the lesion to the centre, once a week. This continued until the entire lesion turned white and healed, leaving a 0.3 cm scar.

**Figure 3:** *The lesion on the right cheek of the patient*

**CASE 4**

A 60-year-old female patient applied to our outpatient clinic with a wound on her left arm for 1 month. In the dermatological examination, there were five nodular lesions, each 2 cm in diameter, with an erythematous base and yellow crusting in the center on the volar side of the left arm, and a palpable ulcerated lesion on the dorsum of the left hand, 8x4 cm in diameter, with an erythematous base and widespread black crusting in the center, surrounded by satellite nodules in the periphery.

The patient lives in the Antakya district of Hatay province. She was born in Idlib and has a history of regular visits to Syria. She described a history of fly bites. No one else in the house had similar wounds. There was no history of animal husbandry or gardening.

The patient, who was followed up in internal medicine endocrinology with a known diagnosis of diabetes mellitus and in cardiology with a diagnosis of heart failure, was treated with insulin, captopril, isosorbide dinitrate, atorvastatin, ranolazine, trimetazidine, clopidogrel, dapagliflozin, olmesartan/hydrochlorothiazide, and acetylsalicylic acid treatments.

A leishmania smear was performed with a preliminary diagnosis of Sporotrichoid leishmaniasis due to the patient's history of being in Syria, an endemic region for leishmaniasis. The patient, whose smear blood smear result was positive, was prescribed intralesional 5-glucantime injections and was referred to the Hatay Provincial Health Directorate. The patient stated that he wanted to continue the treatment injections at an external centre. During the control visit, it was observed that the lesions were regressing.

**CASE 5**

A 54-year-old male patient applied to our outpatient clinic with a wound complaint on his left leg for 1 year. In the dermatological examination, there were nodular lesions with erythema and ulcerated yellow crusts in the middle of the anterior surface of the left tibia.

The patient lives in the Reyhanlı district of Hatay province. He was a Syrian and had a history of going to and coming from Syria. He described a history of fly bites. Similar wounds were also present in the people he lives with at home. He had no prior experience in animal husbandry. He had no known contact with gardens and no known diseases.

Due to the patient's history of residing in Syria, an endemic region for Leishmaniasis, similar complaints in the family, and the description of fly bites, a Leishmania smear was performed, yielding a preliminary diagnosis of Sporotrichoid leishmaniasis. The patient, whose smear blood smear result was positive, was admitted to the ward, and intramuscular glucantime treatment was started. As a result of the treatment, the patient's lesions healed with scarring.

**Figure 4:** *Leishmania lesions on the left leg*

**CASE 6**

A 63-year-old Syrian male patient who lived in the Reyhanlı district of Hatay applied to our outpatient clinic with complaints of wounds on the nose, ears and hands for 3 years. During the dermatological examination, crusted, infiltrative plaques were detected on the patient's nose, ears, and dorsal surfaces of the hands. He did not describe a history of fly bites. No one else in the house had similar wounds. There was no history of animal husbandry, no contact with gardens, and no additional diseases were reported. He did not regularly use any medication. A skin biopsy was performed on the patient with the preliminary diagnoses of pyoderma gangrenosum, atypical mycobacterial infection, sporotrichosis and basal cell carcinoma. Histopathological examination revealed epithelioid granulomas under the stratified squamous epithelium, numerous lymphocytes, plasma cells, and multinucleated giant cell infiltration around these granulomas, as well as basophilic-looking amastigotes with both extracellular and intracellular localisation. These structures stained positively with Giemsa stain.

The patient was diagnosed with leishmaniasis with histopathological examination. The patient was admitted to the ward, and intramuscular glucantime treatment was started. As a result of the treatment, the patient's lesions healed with scarring.

**Figure 5:** *Leishmania lesions on the nose, ears and hands*

***CASE 7***

A 46-year-old female patient. She applied to our clinic with a red wound on the front of the ear. In the patient's dermatological examination, an erythematous, asymptomatic plaque was observed on the front of the left ear. She does not describe a history of fly bites. No one else in the house has a similar wound. There was no history of animal husbandry, no garden contact and no additional disease. She did not use any medications regularly.

A biopsy was taken from the patient with the preliminary diagnoses of discoid lupus erythematosus, lupus vulgaris, Bowen's disease, sarcoidosis, squamous cell carcinoma, insect bite, and leishmania. In the histopathological examination, infiltration consisting of histiocytes, lymphocytes, and plasma cells, as well as granulomas and amastigotes within macrophages, was observed. It stained positive with Giemsa stain.

**Figure 6:** *Leishmaniasis lesions on the front of the ear*

The patient was diagnosed with leishmaniasis. The patient, who was reported to have leishmaniasis, was treated with five sessions of glucantime treatment using a papule formation technique, with injections at 1 cm intervals from the periphery of the lesion to the centre, administered once a week, intralesionally, until the entire lesion turned white. With the treatment, the patient's lesion healed without scarring..

## Discussion

The incidence of CL is closely related to the ecology, climate, and geographic distribution of vectors and reservoirs in the region. Both the host's lifestyle and behavioural patterns, as well as the vector's reproduction and life characteristics, are essential in CL epidemiology. People infected with the disease, who migrate from endemic to non-endemic regions, can carry it to that region if there are suitable vectors and favourable environmental and climatic conditions. At the same time, uninfected people have a higher risk of infection than the local people when they come to endemic regions. For these reasons, CL epidemics often occur in migrants and non-susceptible individuals who come to endemic regions. There are focal foci of leishmaniasis in most endemic regions. These areas are associated with microecological conditions that affect the vector, parasite, and reservoir host (7). The distribution and spread of the disease are related to economic status, behaviour and environmental changes. New settlements, settlements in forest areas, destruction of forests, migration from rural areas to cities, rapid and unplanned urbanization, increase in dog and rodent populations, decrease in insecticide use, increase in the number of immunosuppressed hosts, construction of dams, new irrigation projects, migrations due to various reasons, especially war and natural disasters, play an essential role in the spread of the disease (8). It is believed that the population of vector organisms will increase due to the effects of global warming and related climate changes, and their breeding and living areas will expand from sea level to higher altitudes and northern latitudes. CL is a climate-sensitive disease; changes in temperature, precipitation, and humidity rates can affect sandflies and reservoir hosts by altering their distribution, survival time, and population size. The formation of slums in areas where rodent reservoir hosts are densely located as a result of unplanned urbanisation and migration to cities has caused an increase in the incidence of leishmaniasis in these areas (9).

In Turkey, CL is endemic in the Southeastern Anatolia region and the Çukurova region of the Mediterranean region. According to the Ministry of Health's data, approximately half of the 50.381 cases detected throughout the country between 1988 and 2010 were reported from Şanlıurfa province, with 96% of these cases also reported from Şanlıurfa, Adana, Osmaniye, Hatay, Diyarbakır, İçel, and Kahramanmaraş provinces. Şanlıurfa is followed by Adana, Osmaniye, Hatay, Diyarbakır, İçel, Kahramanmaraş, Antalya, Aydın, Kayseri, Niğde, Muş and 47 other provinces that have reported cases (10). In recent years, cases reported from non-endemic regions such as the Western and Northern regions of Turkey consist of refugees from neighbouring countries, especially Syria, and/or people coming from our endemic provinces for work and education purposes. Although CL is concentrated in certain regions, the long incubation period of the disease and the slow progression of the lesions allow the disease to be detected and diagnosed outside of the areas where it is endemic (11). Due to increased travel to endemic areas and military operations, the number of CL cases has increased in developed countries since the 1990s. Although it is a disease that can occur at all ages, it is more common in children in endemic regions (11, 12).

The characteristics of the host and the parasite determine the formation and healing process of CL. Since leishmaniasis is generally an infection closely related to the immune system, the parasite is often eliminated in many people who acquire it, and clinical infection does not develop. The CL lesion begins as an erythematous papule in areas not covered by clothing, such as the face, neck and extremities, where the infected female sand fly bites. It grows slowly and develops into a nodule or plaque, accompanied by a tightly adherent, crust-covered ulcer in the centre over weeks or months (13). When the hard shell tightly attached to the ulcerated lesion is removed, nail-like protrusions are seen on the underside of the shell, which is called Hulusi Behçet's "nail sign". In the case of multiple bites, there may be various lesions, and these lesions are generally of the same characteristics. Sporotrichosis-like lesions, characterised by nodular lymphangitis resulting from lymphatic spread, have been described. The lesions are typically painless, unless a secondary bacterial infection occurs. CL caused by L. tropica is known as the anthroponotic or dry type and is seen in non-rural areas. The lesions ulcerate slowly and late. There are often multiple, dry, ulcerated nodules and plaques. The lesions typically heal within a year or more, leaving a scar in their place. The incubation period ranges typically from 2 to 8 months (14). CL caused by L. major is known as the zoonotic or wet type and is seen in rural areas. It progresses rapidly. The lesions are severely inflamed and ulcerated, typically healing within 2-8 months. Lesions, which are often multiple, may leave large, unsightly, or dysfunctional scars. CL caused by L. infantum is seen in the Mediterranean basin. L. infantum may also cause visceral leishmaniasis in children (15).

Acute CL lesions usually heal within 1-2 years, leaving a sunken scar. Lesions that persist for more than 2 years are classified as chronic CL. Chronic CL may occur when primary lesions persist for more than 2 years *(Lupoid leishmaniasis)* or when the scar on the healed primary lesion becomes reactivated months or years later *(Residual leishmaniasis)*. Anthroponotic, and more rarely zoonotic, CL may develop into lupoid leishmaniasis, which resembles lupus vulgaris (16). L. tropica almost always causes residual CL. Chronic CL may persist for years. The presence of a small number of amastigotes in the lesion may cause a delay in diagnosis. Cutaneous disease may be disseminated *(diffuse CL)*, especially in immunosuppressed individuals. This form may be confused with lepromatous leprosy. Mucosal lesions are rare in Old World leishmaniasis, and mucosal dissemination may occur in elderly or immunosuppressed individuals (17).

For the diagnosis of CL, parasitological confirmation is required in patients with a history of living in endemic areas or travelling to endemic regions, as well as clinical findings suggestive of the disease. The material for the smear should be taken from the most recent and active lesion that is not secondarily infected. The diagnosis is confirmed by the observation of amastigotes in microscopic examination of Giemsa-stained smears. Amastigotes are numerous in early lesions, and few in late and secondarily infected lesions. Since amastigotes are very few in chronic cases, they are challenging to detect (18).

In addition, the pressure smear method, acceptable needle aspirate method, culture, incisional skin biopsy, and polymerase chain reaction method are used in diagnosis, performed on biopsy material or samples sent from skin aspirates. Today, two methods are most commonly used for determining Leishmania species: isoenzyme electrophoresis and PCR. Nicolle-Novy-MacNeal *(NNN)* or modified NNN media are used for Leishmania culture. Positive results are usually obtained from cultures within a week. Under normal conditions, approximately 70% of positive samples show growth. Leishmania cannot grow in the presence of bacterial contamination. Therefore, aseptic conditions should be used for culture in media (19). Histopathologically, an inflammatory infiltrate consisting of histiocytes, lymphocytes and plasma cells is seen in the dermis in CL. Amastigotes are found inside and outside the macrophages. Over time, the number of epithelioid cells and giant cells increases, while the number of amastigotes decreases. In chronic lesions, a granulomatous dermatitis pattern is observed. The clinical spectrum of CL is quite broad and can mimic many other skin diseases (20).

CL is not a life-threatening disease that can cause serious problems, and spontaneous recovery is usually observed. Therefore, it is not necessary to treat every patient. The benefits of treatment are that it accelerates recovery, reduces the possibility of recurrence, prevents/reduces scar formation, reduces the risk of disease spread *(disseminated cutaneous, mucosal),* and reduces the infectious source, especially in anthroponotic CL. The drug or treatment approach to be used in CL should not cause life-threatening complications. Treatment should not be initiated until the disease diagnosis is confirmed. The risk-benefit ratio should be considered for each patient when making a treatment decision. Various treatment methods, including local, systemic, and physical, have been employed in the treatment of CL. The type of parasite, geographic region, and the patient's immunological status affect the effectiveness of the treatment (21). The primary treatment approach in uncomplicated CL cases is local treatment. Wound care and local treatment have been found effective in uncomplicated CL cases, which L. tropica and L. infantum primarily cause (22). It is essential to keep the lesion clean, as secondary bacterial infection can cause serious complications. The most preferred drugs in CL treatment are pentavalent antimony *(SbV)* compounds. These compounds have been the basis of leishmaniasis treatment since the 1940s (2). The best known pentavalent antimony compounds are: meglumine antimonate *(Glucantime®)* and sodium stibogluconate *(Pentostam®) (23)*. These drugs can be applied intralesionally or systemically. Due to the toxicity risk of systemic treatment doses, the most preferred method is IL meglumine antimonate treatment. However, if the area of the lesion, the number, size and condition of the lesions are not suitable for IL treatment or if there is no response to IL treatment, systemic treatment can also be applied (24).

The effectiveness of cryotherapy has been reported to range from 53% to 100% in clinical studies. Cryotherapy followed by IL SbV local treatment is more effective. In small, non-ulcerated new lesions, cryotherapy can be applied alone. It is recommended to use liquid nitrogen for 15-20 seconds, creating a 1-2 mm ice ring around the lesion, followed by a 20-60 second interval and then another 15-20 seconds of liquid nitrogen. This application can be repeated every three weeks until the healing process is complete. Cryotherapy can cause erythema, oedema, bullae, permanent pigment changes and scarring (25). Thermotherapy can be used as an alternative treatment to cryotherapy in small lesions that are not localised on the eyelids, nose, lips or ears (26).

Clusters of metals in their neutral oxidation states are known as metallic nanoparticles *(NP)* (27). The existence of surface plasmons, which resonate when they interact with electromagnetic radiation to produce a plasmonic band, is a crucial characteristic of this group. The size, shape, and type of metal used in the nanoparticles all affect the location of the plasmonic band in the electromagnetic spectrum. Targeting both promastigotes and amastigotes versions of Leishmania protozoans, metallic nanoparticles have shown promise in antibacterial, anticancer, and antileishmanial properties (28, 29). The elevated levels of reactive oxygen species *(ROS)* are the main factor linked to their mode of action. Rapid surface oxidation is made possible by the high surface-to-volume ratio of metallic nanoparticles (30). Although macrophages produce ROS as a defence mechanism, Leishmania parasites are usually not killed by the amount of ROS produced. 87 By blocking the macrophages' enzymatic pathways, these parasites have evolved defences against oxidative stress. The lattice of the nanoparticle releases metal ions, which increase ROS levels within the cell and enhance the efficacy of the parasiticidal activity (31).

The range of nanomaterials covered, including oxides, carbon-based compounds, and metallic nanoparticles, emphasises their potential as potent anti-Leishmanial treatment agents. The distinct physicochemical characteristics of these nanomaterials—such as their size, shape, chemical composition, and surface charge—are crucial to their antileishmanial action, as they facilitate membrane penetration and induce cell death. More research into synthesis techniques to alter their surfaces and compositions, however, may result in more effective systems. By surface-functionalizing nanomaterials with biocompatible compounds, for example, the problem of reducing damage to macrophages can be addressed, thereby increasing the selectivity index necessary for optimal treatment (32).

## Conclusion

CL affects individuals of all ages and genders, and its incidence increases in situations such as war and natural disasters. Migration due to war and changes in living conditions causes delays in the diagnosis and treatment of the disease, as well as some difficulties in controlling it. In particular, in recent years, patients diagnosed with cutaneous leishmaniasis among refugees migrating from Syria to our country have caused an increase in the disease in our country and affected epidemiological data. Therefore, importance should be given to the necessary health screenings of those entering the country, the implementation of vector control programs and public education on this issue.

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Acta Medica Young Doctors

Case Report

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# Aortic Dissection With Isolated Bradycardıa and Epigastric Paın: a Case Report

## ABSTRACT

Aortic dissection is typically an emergency condition characterised by sudden onset of back pain, tearing-like chest pain, dizziness, vomiting, and sweating. In this case, we aimed to present a case of silent aortic dissection accompanied by isolated bradycardia and epigastric pain. A 74-year-old male patient with known diabetes mellitus, hypertension, coronary artery disease, cholesterol and arrhythmia presented to the district state hospital with sudden onset epigastric pain at home. The patient's tests in the district were normal, but he was referred to our hospital due to his newly developed bradycardia and persistent epigastric pain. The patient, who did not present with a severe clinical picture and was found to have a Stanford Type A dissection on computed tomography angiography, underwent emergency surgery by the Department of Cardiovascular Surgery.

**Keywords:** Bradycardia, Epigastric Pain, Aortic Dissection, Emergency Department

## Introduction

Aortic dissection is typically an acute surgical emergency characterised by sudden onset of back pain, tearing chest pain, dizziness, vomiting, and sweating, which can progress to a fatal course within minutes to hours. It has a mortality rate of 33%, 50%, and 75% at 24 hours, 48 hours, and 2 weeks, respectively (1-2). We present a case of silent aortic dissection accompanied by isolated bradycardia and epigastric pain.

Aortic dissection involves various risk factors, with hypertension and known connective tissue diseases being the most common. Patients most frequently present with sudden-onset severe chest or back pain not accompanied by myocardial ischaemia. Increased severe chest or back pain after strenuous exercise or drug use strongly suggests acute aortic dissection. Patients typically describe sudden onset of the worst pain they have ever experienced, radiating from the chest to the lower back. Neurological symptoms, including central nervous system symptoms such as syncope, and various spinal symptoms such as paraparesis or paraplegia, may also be the first symptoms, albeit rarely (1).

**Case Report**

A 74-year-old male patient with known diabetes mellitus, hypertension, coronary artery disease, high cholesterol and arrhythmia presented to the district state hospital complaining of sudden onset epigastric pain and fainting at home. Following normal findings on examination at the district state hospital, the patient was transferred to our hospital with a provisional diagnosis of acute coronary syndrome, having been administered 300 mg of aspirin, due to the presence of newly developed bradycardia and persistent epigastric pain, with troponin testing and cardiology consultation requested.

The patient brought in by 112 was in good general condition, not sweating, with a Glasgow Coma Scale score of 15. Breathing sounds were normal on auscultation, there was no neurological deficit, blood pressure was 120/72 mmHg, and pulses were present in all four extremities. The patient reported isolated epigastric pain, and the ECG showed sinus bradycardia with a rate of 48/min (Figure 1). Laboratory parameters were as follows: haemoglobin 13.2 g/dl, WBC 9860 µ, platelets 180,000 µL, creatinine 1.13 mg/dl, total bilirubin 0.8 mg/dl, CRP 0.1 mg/L, INR 1.1, troponin 0.006 ng/ml, blood gas was normal.

As the patient's epigastric pain did not subside and the patient described presyncope, a control troponin test was taken and computed tomography angiography was performed on the upper and lower abdomen and in the dissection phase.

The patient was referred to cardiology due to bradycardia and epigastric pain. Given the bradycardia responding to atropine and the epigastric pain, a follow-up consultation was recommended with a control troponin result.

The patient, who was observed to have a Stanford-A aortic dissection on computed tomography angiography, was referred to cardiac and vascular surgery. The echocardiogram performed by cardiology showed an ejection fraction of 60%, mild aortic insufficiency, and a dissection flap in the ascending aorta (Figure 2). The computed tomography angiography report stated, 'The ascending aorta diameter was measured at approximately 47 mm and was dilated. an intimal flap consistent with a DeBakey I-Stanford type A dissection extending from the level of the ascending aorta to the aortic arch, descending aorta, abdominal aorta, and both common iliac arteries and the right external iliac artery' (Figures 3-4-5-6).

Our patient was taken into emergency surgery by the Cardiovascular Surgery Department and passed away at the end of the 7-hour operation.

**Discussions**

An analysis conducted in the International Acute Aortic Dissection Registry reported that the average age of aortic dissection was 63, it was more common in men (65%), and the incidence in men was 16 per 100,000 (3). In our case, consistent with the literature, the patient was male and 74 years old. We believe that its prevalence in older age groups and males is related to cardiovascular risk factors.

The clinical presentation most commonly involves sudden onset of severe chest pain, but may also include aortic insufficiency, cardiac tamponade, and end-organ ischaemia (4). Although these cases typically present with severe clinical symptoms, they may occasionally present with a silent clinical course. In our case, there was clinically isolated epigastric pain and newly developed bradycardia. We should also consider aortic dissection in patients presenting to our emergency departments with newly developed bradycardia. Acute coronary syndrome and aortic dissection should also be included in the differential diagnosis of our patients with epigastric pain.

Stanford Type A aortic dissection typically presents with atypical symptoms such as chest pain, orthopnoea, and exertional dyspnoea, whereas Type B aortic dissection usually presents with back pain. Risk factors that increase aortic dissection include advancing age, hypertension, diabetes mellitus, atherosclerosis, and renal failure (2). Our patient presented with epigastric chest pain and had a Type A dissection extending from the ascending aorta to the aortic arch, descending aorta, abdominal aorta, and both main iliac arteries and the right external iliac artery. The patient was referred to our hospital from the district state hospital with a preliminary diagnosis of acute coronary syndrome. Although there were no signs of ischaemia on the electrocardiogram, the initial troponin test was negative. When making a differential diagnosis in patients with symptoms of acute coronary syndrome, we must not forget aortic dissection. Consistent with the literature, our patient had risk factors including diabetes mellitus, hypertension, coronary artery disease, high cholesterol, and arrhythmia. We believe that we should also practise preventive medicine by informing patients with uncontrolled or newly diagnosed hypertension who present to our emergency departments and consulting with them when necessary.

Controlling blood pressure is important in the initial management of patients with aortic dissection. The aim of hypertension treatment is to reduce stress on the aortic wall and limit the progression of the dissection. Although intravenous beta-blockers are recommended for treatment, systolic blood pressure should be titrated to between 100 and 120 mmHg (5-6). Since our patient's blood pressure remained around 110/80 mmHg during monitored follow-ups from the time of admission, we did not administer antihypertensive treatment.

In cases of aortic dissection, ischaemic and neurological problems also occur as a result of occlusion caused by pressure on the false lumen (7-8). Our patient described a brief episode of fainting as presyncope. We should also suspect aortic dissection in patients presenting to the emergency department with syncope and presyncope.

It is quite difficult to make a differential diagnosis in patients with aortic dissection who present with atypical symptoms (9). We must remember that patients presenting to the emergency department with bradycardia and epigastric pain should undergo the necessary investigations as soon as possible, and that aortic dissection can also present with atypical symptoms and has a high mortality rate.

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Orginal Article

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# Impact Characteristics of Pneumothorax Videos Published on YouTube: 2020-2025

## ABSTRACT

**Background:** Pneumothorax is a potentially life-threatening condition characterized by air accumulation in the pleural space, leading to partial or complete lung collapse. YouTube, as one of the most widely used digital platforms, has become a significant educational tool for medical learning. However, the quality and reliability of medical content on the platform remain variable. Given the limited number of studies assessing pneumothorax-related videos, this study aimed to evaluate the characteristics and engagement metrics of pneumothorax videos published on YouTube between 2020 and 2025.

**Methods:** A custom YouTube API-based data extraction tool was developed to collect pneumothorax-related videos and metadata. After excluding incomplete or irrelevant videos, a total of 570 videos were analyzed. Descriptive statistics were generated, and the interaction index was calculated as [(likes – dislikes) / total views] × 100. Data were analyzed using SPSS version 27. Categorical data were expressed as frequencies and percentages, while non-normally distributed numerical variables were presented as medians and interquartile ranges. Kruskal-Wallis tests were performed, with $p<0.05$ considered statistically significant.

**Results:** Video publication increased markedly over time, peaking in 2025 (52.5%). The largest number of videos originated from India (22.1%) and the United States (18.2%). The interaction index significantly differed by year (test statistic=16.255, $p=0.006$), with 2025 showing higher engagement compared to 2024 ($p=0.009$). Median video duration was 60 seconds, median like count was 21, and median view rate was 645.33%.

**Conclusion:** Despite increasing engagement, variability in video quality underscores the need for medical professionals and educators to contribute accurate and evidence-based content.

**Keywords**: Pneumothorax, Youtube, Video education

## Introduction

Pneumothorax is a medical condition characterised by air in the pleural space, which can cause lung lobes to collapse. It can be caused by various factors, including trauma or medical procedures, or it can occur spontaneously for no apparent reason [1]. Depending on the extent of air accumulation and the patient's underlying health status, the condition can range from asymptomatic to life-threatening [2]. Management strategies vary based on the severity and type of pneumothorax, ranging from conservative monitoring to surgical intervention [3]. The classification of pneumothorax is based on its aetiology, with the condition being divided into three distinct categories. The term "spontaneous pneumothorax" is used to denote cases of the condition in which there is an accidental collapse of the lung, either as a result of a traumatic injury or iatrogenically. Primary spontaneous pneumothorax is a condition characterised by the rupture of small air sacs (blebs or bullae) on the lung surface, typically without an underlying significant lung disease. The prevalence of this condition is highest among tall, slim, young men who smoke. Secondary spontaneous pneumothorax is a complication arising from underlying lung diseases, including COPD, emphysema, cystic fibrosis and pneumonia [4,5].

YouTube has emerged as a substantial educational resource within the domain of medicine, presenting both prospects and challenges. It has been demonstrated that medical students frequently utilise [6] YouTube as a supplementary resource, particularly in domains such as physical examination and clinical skills, where visual aids have been shown to enhance comprehension and retention. Nevertheless, the quality and reliability of the content can vary considerably, necessitating careful evaluation by both students and educators [7]. Since there are not enough studies in the literature on the use of YouTube videos in patients with pneumothorax, we wanted to investigate the use of YouTube videos in patients with pneumothorax in this study.

## Methods

### Data Acquisition and Preparation

The study was conducted using a systematic, step-wise data acquisition and preparation process. Initially, a dedicated **Application Programming Interface (API)** was developed to access and extract the required data. Following API development, the specific **data parameters and criteria** (e.g., relevant video titles, upload dates, and platform) were precisely defined [8].

An **appropriate script** was then coded to interface with the API and automate the data collection process [9]. This procedure resulted in the **initial acquisition of 612 videos** (N=612) and their associated metadata.

### Data Validation and Filtering

Following the initial acquisition, a rigorous **data quality check and filtering** process was executed to ensure the reliability and relevance of the final dataset. This filtering involved two primary steps:

1. **Exclusion of Incomplete Data:** Data entries with missing critical variables, such as unreachable like counts or disabled comments, were identified and **excluded (n=15)**.
2. **Exclusion of Irrelevant Data:** Videos determined to be outside the

defined scope or topic of the study were also systematically **excluded (n=27)**.

After this comprehensive filtering process, the **final validated dataset** was determined and prepared for subsequent analysis.

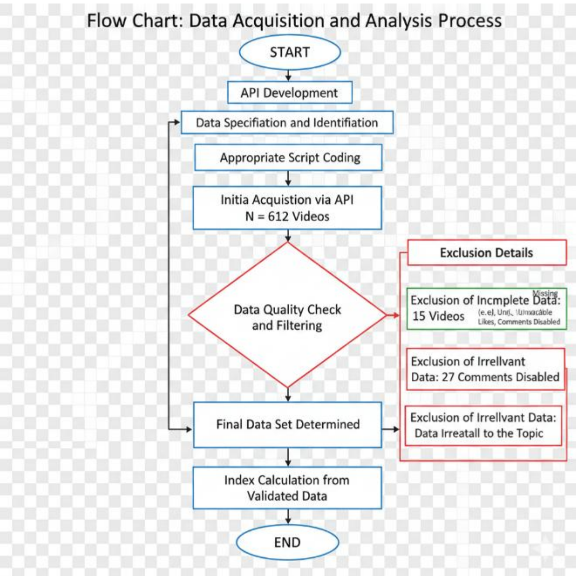
### Index Calculation

Using the finalized and validated dataset, specific **quantitative indices** relevant to the study's objectives were calculated for each data entry. Finally, the processed data, including the calculated indices, underwent **statistical analysis** using appropriate methods to test the study hypotheses. Figure 1 shows the workflow.

### Statistical Analysis

Data were collected via script to create a database and analysed using SPSS version 27 (USA). Data types were evaluated. Categorical data were defined as percentages and frequencies, while distribution analysis was performed for numerical data. Data that did not conform to a normal distribution were defined as medians and interquartile ranges. A Kruskall Wallis analysis was performed between numerical values, and findings with a p-value above 0.05 were considered significant.

Figure 1: Flow Chart




## Results

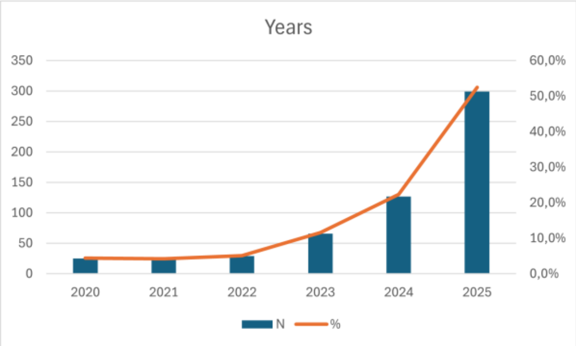
Of the videos included in the study, 4.4% were published in 2020, 4.2% in 2021, 5.1% in 2022, 11.6% in 2023, and 22.3% in 2024, while the highest number of videos shared, 52.5%, occurred in 2025. Figure 2 shows the distribution by year. When examining the geographical distribution of the videos, a significant concentration of data was observed. According to the distribution presented in Figure 3, a significant portion of the sample examined comes from only two countries: India (22.1%, n=126) and the United States (18.2%, n=104). These two countries account for more than half (40.3%) of the total known data. Other notable contributions come from countries such as Pakistan (3.7%, n=21), Canada (3.3%, n=19), France (2.8%, n=16), the United Kingdom (2.6%, n=15) and Germany (2.5%, n=14). On the other hand, the geographical origin of a significant portion of the sample is **unknown**, accounting for nearly one-third of the total sample (32.1%, n=183). This situation requires caution regarding generalisability, particularly for regions outside India and the United States. Table 1 presents the descriptive information of the videos examined.

A significant difference was detected in the comparison of the Interaction index by year (Test statistic=16.255, p=0.006). The 2025 value was found to be significantly higher than that of 2024 (p=0.009). Figure 4 shows the comparison of the Interaction index by year.

Table 1: Descriptives variables

| Variables | Median (IQR) |
|---|---|
| Duration (second) | 60 (269,5) |
| Like count | 21 (147,5) |
| Comment count | 1 (7) |
| Days since upload | 277(635) |
| Interaction index (%) | 1124 (2,91) |
| View rate (%) | 645,33 (3627,07) |

Figure 2: Distribution by year




## Discussion

In the 21(st) century, medical education has undergone a digital revolution. Conventional didactic teaching methods are progressively being supplemented or replaced by digital resources, online platforms, and multimedia tools. Among these, YouTube is distinguished as a particularly accessible and influential platform. Established in 2005, YouTube has grown to host over 2 billion monthly users, with a vast repository of content pertaining to health, medicine and healthcare practices [10,11]. The platform's visual and interactive nature provides a unique medium for explaining complex medical concepts, demonstrating procedures, and promoting health literacy. Nevertheless, the utilisation of YouTube in educational contexts is a multifaceted issue, bearing both advantages and disadvantages. While it has been demonstrated to enhance engagement and learning flexibility, it has also been demonstrated to open doors to misinformation and inconsistent content quality [12,13]. In our study, the most common videos were **India** and **the United States**.

Medicine frequently encompasses intricate anatomical, physiological and procedural concepts that are optimised by visual representation. The capacity of YouTube videos to demonstrate surgical techniques, clinical procedures, and pathophysiological mechanisms in a manner that textbooks cannot is well-documented [14]. To illustrate this point, the utilisation of instructional videos pertaining to chest tube insertion, pneumothorax management, and cardiopulmonary resuscitation facilitates the conceptualisation of practical methodologies by learners, thereby reinforcing theoretical knowledge through observational learning [15,16]. Research suggests that visual learning improves knowledge retention and comprehension among medical students. The asynchronous format of YouTube also allows learners to pause, replay, and review content at their own pace, which is an essential feature for mastering procedural skills. YouTube has been demonstrated to foster a community-based learning environment [17]. It is an opportunity for students, physicians and educators to engage in a dynamic discourse, wherein they can share their experiential knowledge, offer constructive feedback on video presentations, and engage in deliberations concerning clinical scenarios in real time [18]. This interactive element has been demonstrated to promote critical thinking and collaborative learning. Furthermore, student-led channels and educator-curated playlists have become popular resources in medical schools, especially for exam preparation (e.g., for the USMLE or PLAB exams). This formula is utilised in academic studies and social media analytics to assess the engagement of YouTube videos with their viewership [19]. Definition: The term "engagement" is used to denote the number of likes and dislikes a video receives, which is then normalised by the total number of views the video has received. The metric is indicative of the extent of engagement or discussion that the video content has generated. The following formula is frequently employed: Engagement Index = (Likes – Dislikes)/Total Views The symbol "×100" is employed to denote a multiplication of a given quantity by a constant. The primary function of this symbol is in the context of academic papers that undertake a qualitative, quantitative, or empirical analysis of the prevalence, esteem, or repercussions of medical, scientific, or educational videos. Illustrative examples of such videos include those addressing subjects such as root resorption or anaesthesia. It is evident that a high index denotes a considerable propensity for the video to elicit a robust response from its viewers [20,21]. As demonstrated in the present study, a statistically significant discrepancy was identified in the Interaction Index when evaluated across different periods (test statistic=16,255, p=0.006). As shown in Figure 1, the 2025 value is significantly higher than the 2024 value (p = 0.009).

A significant proportion of medical students employ YouTube for educational purposes. For instance, a study conducted in Jordan revealed that 91% of students reported utilising YouTube as a learning tool, with an additional 96.4% finding it to be beneficial for their academic pursuits [22,23]. YouTube videos are frequently regarded as a more efficacious medium for learning than conventional lectures, with a study conducted at Qassim University indicating that 95.3% of students utilise them as a resource [24]. The platform facilitates self-paced learning, enabling students to review complex subjects as required, a feature that is particularly advantageous in disciplines such as internal medicine and general surgery. Notwithstanding its popularity, the quality of medical content on YouTube is inconsistent. A significant number of videos have been found to exhibit substandard quality, characterised by elevated levels of bias and diminished reliability scores, as substantiated by studies employing the DISCERN criteria [25]. A substantial proportion of health-related content has been found to be misleading. In a particular study, it was determined that 25.9% of videos contained inaccurate information. The absence of regulatory oversight and the unrestricted nature of the platform engender a situation wherein users are subjected to content of varying quality and reliability [26,27]. This underscores the necessity for enhanced information literacy among students. YouTube's global accessibility facilitates the dissemination of medical education content to a vast audience, including those in low- and middle-income countries, which constituted 42% of views on a medical education channel . The platform's capacity to disseminate information expeditiously and extensively can be advantageous; however, it also underscores the importance of ensuring the accuracy and reliability of the content shared [28].

It is important to note that the survey is not without its limitations. Initially, the focus was exclusively on videos hosted on the YouTube platform. Secondly, the evaluation process was restricted exclusively to videos that were narrated or voiced in English. Furthermore, it was not possible to search for and evaluate private or unlisted videos on YouTube. Concurrently, a qualitative analysis was not conducted to evaluate the comments posted alongside the videos. It is regrettable to note that YouTube has removed the functionality of disliking content. In conclusion, the results of this study are representative of a specific moment in time and a particular region, albeit with a limited sample size. Given the rapid growth of social media platforms, it is important to note that the findings may vary greatly over time.

## Conclusion

Videos on social media platforms can help the public and medical learning about the knowledge of pneumothorax.

Figure 3: Distribution by country

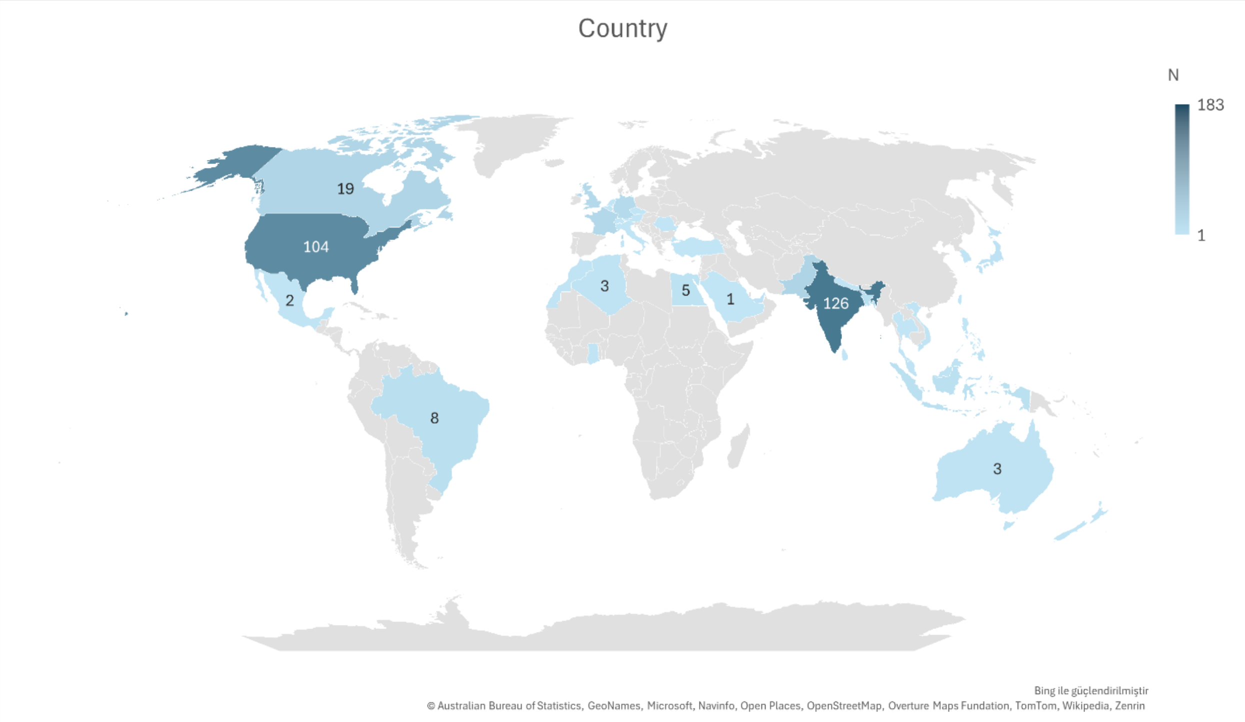
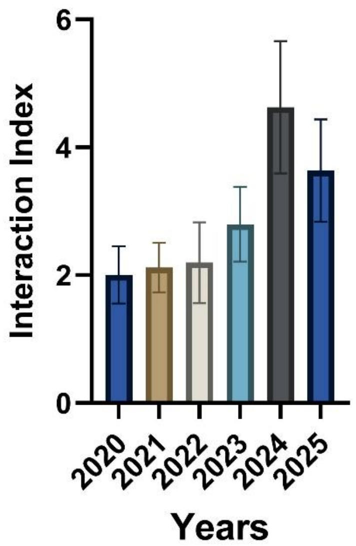



Figure 4: Comperation by years

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Orginal Article

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# Evaluatıon of Volume Status And Treatment Response With Point-of-Care Inferior Vena Cava Ultrasound in Patients Wıth Gastroıntestınal Bleeding

## ABSTRACT

**Backgraund:** Gastrointestinal bleeding (GIB) is a medical problem with significant morbidity and mortality and high consumption of healthcare resources, and is one of the main reasons for consultation in emergency department (ED). In critically ill patients, measuring the Inferior Vena Cava (IVC) diameter by bedside ultrasonography helps in the evaluation of intravascular status.

**Objective:** The aim of this study was to assess the association of point-of-care ultrasound (POCUS) used by emergency physicians to examine IVC diameter ratio in patients with GIB.

**Methods**: A single-center prospective observational study was conducted on consecutive patients with GIB who presented to the ED. Epidemiological and clinical characteristics of the patients, laboratory results and pre- and post-treatment IVC diameter were measured. Patients were divided into two groups as upper GIB (UGIB) and lower GIB (LGIB) based on endoscopic data.

**Results:** A total of 150 patients were included in our study. 39.3% of the patients were female, 60.7% were male, and the mean age was 59.25 ±19.91 (min: 19, max: 93). 77% (n=116) of the patients presented with UGIB, and 23% (n=34) with LGIB. In patients with UGIB, IVC MIN and IVC MAX values were significantly increased 2 hours after treatment ($p<0.05$); IVCCI value after 2 hours was statistically insignificant ($p>0.05$). In patients with LGIB, IVC MIN, IVC MAX and IVCCI were statistically insignificant in measurements taken 2 hours after treatment (p>0.05). IVC MIN and IVC MAX values of the entire group were significantly increased at the 2-hour measurement after treatment (p<0.05), however, IVCCI changes were statistically insignificant (p>0.05).

**Conclusion:** The inferior vena cava diameter ratio was independently associated with a poor outcome in patients with GIB.

**Keywords**: Inferior vena cava, Gastrointestinal bleeding, Volume Status; Prognosis

## Introduction

Acute gastrointestinal bleeding (GIB) is a potentially life-threatening abdominal emergency and remains a common cause of emergency department (ED) visits and hospitalizations (1, 2). Upper GIB (UGIB) is defined as bleeding derived from a source proximal to the ligament of Treitz. The incidence of UGIB is approximately 100 cases per 100,000 population per year (3). Despite advances in diagnosis and treatment in recent years, the mortality rate in GIB varies between 2 and 15% and, there is no decrease in mortality rate (1, 4, 5). Therefore, in patients presenting to the ED with GIB, it is necessary to have effective decision rules to identify low-risk patients who can be safely discharged and to identify high-risk patients who need more invasive management (6).

Invasive and non-invasive methods are used to assess the intravascular volume status of critically ill patients presenting to the ED and to accurately and rapidly determine their response to fluid therapy (7). In clinical practice, non-invasive methods such as mental status changes, skin turgor pressure and skin dryness, capillary refill time, mucous membrane status, extremity temperature, palpation of peripheral pulses, heart rate and blood pressure, orthostatic blood pressure, and physical examination findings such as urine volume, chest radiography, and laboratory parameters and Invasive methods such as monitoring cardiac output or central venous pressure (CVP) are used (8). Especially in critically ill patients, an invasive method such as central venous catheter insertion is required to determine intravascular volume status and measure CVP (7, 8). Several studies have emphasized that changes in the volume status can be inferred by using point-of-care ultrasound (POCUS). The collapsibility index (CI) of the IVC (IVC CI), which is a ratio of the change in the IVC diameter during the respiratory cycle, currently is being used to estimate the CVP (6, 9).

The use of POCUS as a noninvasive method for hemodynamic monitoring can also guide the clinician in transfusion/resuscitation strategies and identify patients with poor prognosis at an early stage (10). POCUS is a quick, effective, safe, inexpensive, and accurate hemodynamic assessment tool. In recent years, sonographic IVC diameters have been studied in various conditions associated with hypo- and hypervolemia, such as shock, trauma, and heart failure (11). IVC ultrasound is non-invasive and relatively easy to perform, and has been used extensively in the ED. However, there are few studies on sonographic IVC diameters measurements in GIB, where volume status is crucial (6, 11). The purpose of this study was to measurements IVC diameters using POCUS both before and after treatment in patients with acute GIB to determine the patient's fluid status and prognosis.

## Methods

This study was conducted prospectively in patients who applied to Health of Sciences University Antalya Training and Research Hospital Department of Emergency Medicine with GIB between 01/11/2017 and 01/11/2018, after obtaining the approval of the Hospital Ethics Committee numbered 2017-232 (Decision No: 19/02).

Patients under 18 years of age, patients with a preliminary diagnosis of invasive gastroenteritis, patients in whom optimal imaging could not be obtained on ultrasonography due to reasons such as obesity or inability to position, patients diagnosed with GIB at an external center and referred to our hospital, pregnant patients, and patients who did not consent to the study were excluded from the study. The study protocol was developed in accordance with the Declaration of Helsinki. Consent was obtained from patients who were conscious and from their families for those with altered consciousness.

In our study, patients who met the specified criteria were examined for age, gender, comorbidities, medication use, presenting symptoms, vital signs (systolic and diastolic blood pressure, pulse, respiratory rate, O2 saturation), and laboratory results (complete blood count, electrolyte, liver and kidney function tests, coagulation, and blood gas values). Serial sonographic IVC diameter measurements were performed on patients in the inspiratory and expiratory phases pre- and post-treatment. Patients' endoscopy results, Glasgow-Blatchford Score (GBS), medical outcomes (ward admission, intensive care admission, discharge from emergency and exitus) and 30-day mortality rates were calculated. Patients were divided into two groups as upper GIB and lower GIB based on examination findings and endoscopic data.

**Inferior Vena Cava Ultrasonography**

Ultrasonographic imaging was performed at the bedside by two emergency physicians trained in basic and advanced emergency ultrasonography. IVC diameters were quantified in the long axis from the subcostal view with a 4-MHz phased array US transducer (BC; Mindray, Shenzhen, China). To standardize the measurements, the patients were only examined with US when spontaneously breathing, with the patients in the supine position. The intrahepatic IVC was measured from a site that was 1 to 2 cm distant from the right atrium; the inspiratory change in the IVC diameter was recorded. Similarly, the expiratory IVC diameter was quantified, and the inferior vena cava collapsibility index (IVCCI) was determined as follows: [(IVC size on expiration – IVC size on inspiration)/IVC size on expiration] × 100. (10).

The abbreviations IVC MIN was used for inspiratory IVC measurements, and IVC MAX was used for expiratory IVC measurements. The abbreviations IVC-1 MIN and IVC-1 MAX were used for inspiratory and expiratory IVC measurements taken at the time of admission, respectively. The abbreviations IVC-2 MIN and IVC-2 MAX were used for inspiratory and expiratory IVC measurements taken at the second hour, respectively.

**Statistical Analysis**

Study data were analyzed with the SPSS version 22.0 software package for Windows (IBM Corporation, Armonk, NY). A normal distribution was determined by Kolmogorov–Smirnov test. Mean and standard deviation were used to display data conforming to a parametric distribution; median, minimum, and maximum values were used for data that did not. Categorical variables were represented by the number of cases and percentiles. ANOVA and Student t-tests were used to analyze parametric data with categorical variables; Mann-Whitney U and Kruskal-Wallis tests were used to analyze non-parametric data; Pearson chi-square and Fisher exact tests were used to analyze categorical variables with each other; and Pearson correlation tests were used to compare quantitative data. Student t-tests were used to identify the columns that led to significance for parameters identified as significant in the ANOVA test, and Mann-Whitney U tests were used to identify the columns that led to significance in the Kruskal-Wallis test. Data changes over time were analyzed using the paired samples test. A $p$ value of $<0.05$ was considered statistically significant.

## Results

Of the 150 patients included in the study, 39.3% were female, 60.7% were male, and the mean age was 59.25 ± 19.91 years (min: 19, max: 93). 77% (n=116) of the patients presented with UGIB, and 23% (n=34) with LGIB. No difference was found between the groups in terms of age, gender and comorbid diseases (p>0.05). Melena and hematemesis were found to be significantly higher in UGIB, while hematochezia was found to be significantly higher in LGIB (p<0.05). 33% of patients were taking regular medications. The most commonly used medication was low molecular weight heparin (LMWH). No difference was found between the groups in terms of predisposing medication use (p>0.05) (**Table 1**).

In the ultrasonographic measurements taken at admission in patients with UGIB, IVC-1 MIN, IVC-1 MAX and IVCCI-1 were detected as (0.89±0.28; 1.59±0.33; 0.45±0.1), respectively, While in the measurements taken 2 hours later, IVC-2 MIN, IVC-2 MAX and IVCCI-2 were detected as (0.93±0.29; 1.65±0.35; 0.44±0.12), respectively. In patients with LGIB, in the measurements taken at the time of admission, IVC-1 MIN, IVC-1 MAX and IVCCI-1 were detected as (0.99±0.29; 1.68±0.29; 0.42±0.11), respectively, while in the measurements taken 2 hours later, VCI-2 MIN, VCI-2 MAX and IVCCI-2 were detected as (1.02±0.32; 1.73±0.31; 0.42±0.11), respectively (Table 2).

In patients with UGIB, IVC-2 MIN and IVC-2 MAX values were significantly increased 2 hours after treatment (p<0.05); IVCCI-2 value after 2 hours was statistically insignificant (p>0.05). In patients with LGIB, IVC-2 MIN, IVC-2 MAX and IVCCI-2 were statistically insignificant in measurements taken 2 hours later (p>0.05). IVC MIN and IVC MAX values of the entire group were significantly increased at the 2-hour measurement (p<0.05), however, IVCCI changes were statistically insignificant (p>0.05) (Table 3).

According to the endoscopic/colonoscopy results, the most common causes of GI bleeding were duodenal ulcers (42%) (n=63), gastritis (12%) (n=18), and esophageal variceal bleeding (8%) (n=12). No bleeding source was detected In 20 patients (13.3%). According to endoscopy results, the most common ulcer grade in the study group was Forrest 3, at 39.7% (n=25) (Table 4).

The relationship between IVC MIN, IVC MAX, IVCCI levels and patient outcomes is shown in Table 5. IVC-1 MIN and IVCCI-1 levels were significantly lower in patients admitted to the intensive care unit (ICU) than in those admitted to the ward (p<0.05). IVC MIN, IVC MAX, and IVCCI levels were significantly lower in patients who Exitus than in those admitted to the ward and ICU (p<0.05) (Table 5).

In patients who died in hospital, the change in IVC-1 MIN, IVC-1 MAX, and IVCCI-1 values after 2 hours was statistically insignificant (p>0.05). However, in patients who died in hospital, IVC-1 MIN and IVC-1 MAX levels were significantly lower, and IVCCI-1 levels were significantly higher compared to patients who survived (p<0.05) (Table 6).

## Discussion

In our study, no difference was found between the UGIB and LGIB groups in terms of IVC MIN, IVC MAX, and IVCCI values measured at admission and 2 hours after treatment (p>0.05). However, when comparing the groups within themselves, IVC-2 MIN and IVC-2 MAX values were significantly increased in patients with UGIB after treatment (p<0.05); the change in IVCCI-2 over the 2-hour period was statistically insignificant (p>0.05). In patients with LGIB, changes in IVC-2 MIN, IVC-2 MAX, and IVCCI-2 were statistically insignificant (p>0.05). IVC MIN and IVC MAX values in both groups were significantly increased in the 2-hour post-treatment measurement (p<0.05), however, the changes in IVCCI were statistically insignificant (p>0.05). When examining the relationship between patient outcomes and IVC MIN, IVC MAX, and IVCCI values, IVC-1 MIN and IVCCI-1 levels were found to be significantly lower in patients admitted to the ICU than in those admitted to the ward (p<0.05). Furthermore, IVC MIN, IVC MAX, and IVCCI levels in patients who died were found to be significantly lower than in those admitted to the hospital ward and ICU (p<0.05). The results of this study indicate that a high IVC diameter ratio in patients with GIB was associated with poor outcomes.

Previous studies have investigated the association between IVC collapsibility or diameter, and the outcomes of critically ill patients with various diseases. However, there are very few studies that measure IVC collapsibility or diameter with POCUS in the management or in determining the prognosis with GIB (12,13). Multiple scoring systems, such as GBS and AIMS65, have been used to determine the prognosis of patients with GIB (14,15). However, these scoring systems have limitations in identifying high-risk patients who may require in-patient endoscopy, embolization, or surgical treatment, or patients at high risk of death (12).

UGIB can lead to significant hemodynamic instability, necessitating rapid and precise decision-making for effective management. The measurement of the IVC diameter, IVCCI using bedside ultrasonography provides information about the intravascular volüme (16). In cases of UGIB, where volume loss is a prime concern, a collapsible or small IVC may indicate significant hypovolemia, guiding the need for fluid resuscitation or blood transfusion. Conversely, a dilated IVC with minimal respiratory variation might suggest a different pathophysiological mechanism, such as cardiac dysfunction. Given the complexity and rapid progression of UGIB, integrating these measurements into the initial evaluation can be vital. They not only facilitate a more tailored approach to fluid and blood product resuscitation but also may aid in the early identification of patients requiring more aggressive interventions, such as endoscopy or surgery (17).

**Conculusion**

Studies on patients with trauma or septic shock have found a significant relationship between IVC diameter and hypovolemia, blood loss, and in-hospital mortality (18-20). It has also been reported that the IVC diameter ratio is significantly correlated with markers of shock and is a predictor of mortality in patients with trauma and septic shock (21,22). In our study, IVC MIN, IVC MAX, and IVCCI levels of patients who died were found to be significantly lower than those of patients who survived (p<0.05).

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Table 1. Comparison of patients with UGIB and LGIB in terms of demographic and clinical characteristics

| | | **UGIB Median (min-max)/n(%)** | **LGIB Median (min-max)/n(%)** | **Total Median (min-max)/n(%)** | **p** |
|---|---|---|---|---|---|
| **Age** | | 63,5 (20-93) | 65 (19-88) | 64 (19-93) | 0,518 |
| **Gender** | Male | 67 (%57,8) | 24 (%70,6) | 91 (%60,7) | 0,178 |
| | Female | 49 (%42,2) | 10 (%29,4) | 59 (%39,3) | |
| **Symptoms** | Melena | 101 (%87,1) | 5 (%14,7) | 106 (%70,7) | **<0,001** |
| | Hematemesis | 51 (%44) | 0 | 51 (%34) | **<0,001** |
| | Hematochezia | 2 (%1,7) | 29 (%85,3) | 31 (%20,7) | **<0,001** |
| | Syncope | 22 (%19) | 4 (%11,8) | 26 (%17,3) | 0,329 |
| | Other | 5 (%4,3) | 0 | 5 (%3,3) | 0,218 |
| **Comorbidities** | Total | 80 (%69) | 24 (%70,6) | 104 (%69,3) | 0,857 |
| | DM | 28 (%24,1) | 3 (%8,8) | 31 (%20,7) | 0,052 |
| | HT | 27 (%23,3) | 3 (%8,8) | 30 (%20) | 0,064 |
| | CAD | 25 (%21,6) | 7 (%20,6) | 32 (%21,3) | 0,904 |
| | CKD | 16 (%13,8) | 5 (%14,7) | 21 (%14) | >0,999 |
| | AF | 4 (%3,4) | 1 (%2,9) | 5 (%3,3) | >0,999 |
| | CHF | 12 (%10,3) | 2 (%5,9) | 14 (%9,3) | 0,737 |
| | Malignancy | 7 (%6) | 6 (%17,6) | 13 (%8,7) | 0,075 |
| | CH | 4 (%3,4) | 1 (%2,9) | 5 (%3,3) | >0,999 |
| | CVD | 7 (%6) | 2 (%5,9) | 9 (%6) | >0,999 |
| | CLD | 11 (%9,5) | 1 (%2,9) | 12 (%8) | 0,299 |
| | COPD | 2 (%1,7) | 1 (%2,9) | 3 (%2) | 0,540 |
| | Others | 13 (%11,2) | 2 (%5,9) | 15 (%10) | 0,552 |
| **Predisposing Drug Use** | Total | 34 (%31,8) | 11 (%39,3) | 45 (%33,3) | 0,453 |
| | LMWH | 3 (%2,8) | 0 | 3 (%2,2) | >0,999 |
| | Clopidogrel | 16 (%15) | 5 (%17,9) | 21 (%15,6) | 0,770 |
| | NOAC (Apiksaban/Dabigatran) | 5 (%4,7) | 0 | 5 (%3,7) | 0,583 |
| | ASA | 13 (%12,1) | 5 (%17,9) | 18 (%13,3) | 0,531 |
| | Vitamin K antagonist | 2 (%1,9) | 1 (%3,6) | 3 (%2,2) | >0,999 |
| | NSAIDs | 1 (%0,9) | 1 (%3,6) | 2 (%1,5) | 0,373 |

*Mann Whitney U Testi, **Pearson Kikare Testi,*** Fisher Exact Test

DM: Diabetes Mellitus, HT: Hypertension, CAD: Coronary Artery Disease, CKD: Chronic Kidney Disease, AF: Atrial Fibrillation, CHF: Congestive heart failure, CH: Chronic Hepatitis, CVD: Cerebrovascular Disease, CLD: Chronic Liver Disease, COPD: Chronic Obstructive Pulmonary Disease, LMWH: Low-Molecular-Weight Heparin, NOAC: novel oral anticoagulant, ASA: acetylsalicylic acid, NSAIDs: Non-steroidal anti-inflammatory drugs.

Table 2. IVC MIN, IVC MAX, and IVCCI levels, vital signs, laboratory findings, and GBS In patients with UGIB and LGIB.

| | **UGIB Median (min-max)/n(%)** | **LGIB Median (min-max)/n(%)** | **Total Median (min-max)/n(%)** |
|---|---|---|---|
| Pulse | 90 (50-145) | 92 (58-138) | 90 (50-145) |
| SBP | 119,5 (69-196) | 123 (87-187) | 120 (69-196) |
| DBP | | | |
| SpO2 | 96 (75-98) | 95 (90-99) | 95 (75-99) |
| Hemoglobin | 9,45 (3,8-16,4) | 10,6 (3,7-14,8) | 10 (3,7-16,4) |
| BUN | 29 (5-160) | 22 (9-131) | 27,5 (5-160) |
| lactate | 1,87 (0,46-6,14) | 1,42 (0,46-3,9) | 1,7 (0,46-6,14) |
| INR | 1,1 (0,9-8,8) | 1,1 (0,8-1,5) | 1,1 (0,8-8,8) |
| IVC-1 MİN | 0,91±0,29 | 0,89±0,28 | 0,99±0,29 |
| IVC-1 MAX | 1,60±0,32 | 1,59±0,33 | 1,68±0,29 |
| IVCCI-1 | 0,44±0,11 | 0,45±0,1 | 0,42±0,11 |
| IVC-2 MİN | 0,95±0,30 | 0,93±0,29 | 1,02±0,32 |
| IVC-2 MAX | 1,67±0,34 | 1,65±0,35 | 1,73±0,31 |
| IVCCI-2 | 0,44±0,12 | 0,44±0,12 | 0,42±0,11 |
| GBS | 7,5 (0-13) | 10 (0-17) | 9 (0-17) |

Fisher exact test, Mann Whitney U Testi, Student t test

*SBP: systolic blood pressure DBP: diastolic blood Pressure SpO2: oxygen saturation

**Table 3**. IVC MIN, IVCMAX and IVCCI levels in patients with UGIB and LGIB.

| | **UGIB** | | | | **LGIB** | | | |
|---|---|---|---|---|---|---|---|---|
| | Initial value Mean±SD | last value Mean±SD | Change Mean±SD | p | Initial value Mean±SD | last value Mean±SD | Change Mean±SD | p |
| ***IVC-MİN*** | 0,89±0,28 | 0,93±0,29 | -0,04±0,13 | **0,001** | 0,99±0,29 | 1,02±0,32 | -0,03±0,14 | 0,278 |
| ***IVC-MAX*** | 1,59±0,33 | 1,65±0,35 | -0,07±0,19 | **<0,001** | 1,68±0,29 | 1,73±0,31 | -0,05±0,18 | 0,140 |
| **IVC CI** | 0,45±0,1 | 0,44±0,12 | 0,01±0,07 | 0,302 | 0,42±0,11 | 0,42±0,11 | 0±0,06 | 0,737 |

Paired samples test

Table 4. Patients' Endoscopy and Colonoscopy Results and Distribution According to Forrest Classification

| **Endoscopy and Colonoscopy Results** | **n** | **%** |
|---|---|---|
| Duodenal ulcer | 63 | 42,0 |
| Gastritis | 18 | 12,0 |
| Hemorrhoids | 5 | 3,3 |
| Arteriovenöz malformasyon | 2 | 1,3 |
| Esophageal varices | 12 | 8,0 |
| Portal gastropathy | 2 | 1,3 |
| Bleeding source not found | 20 | 13,3 |
| Other | 21 | 14 |
| Endoscopy not performed | 17 | 11,3 |
| **Endoscopic Classification** | | |
| Forrest 1a | 3 | 4,8 |
| Forrest 1b | 5 | 7,9 |
| Forrest 1c | 2 | 3,2 |
| Forrest 2a | 12 | 19,0 |
| Forrest 2b | 16 | 25,4 |
| Forrest 3 | 25 | 39,7 |

**Table 5.** Relationship between patient outcomes and IVC MIN, IVC MAX, and IVCCI levels

| | **Yatış yeri** | | | **p** |
|---|---|---|---|---|
| | **Ward** Mean±SD | **ICU** Mean±SD | **Exitus** Mean±SD | |
| **IVC-1 MIN** | 0,97±0,28 | 0,79±0,23 | 0,38±0,06 | **<0,001ABC** |
| **IVC-1 MAX** | 1,62±0,32 | 1,6±0,32 | 1,09±0,02 | **0,018BC** |
| **IVCCI-1** | 0,41±0,09 | 0,51±0,1 | 0,65±0,06 | **<0,001ABC** |
| **IVC-2 MIN** | 1,03±0,28 | 0,77±0,22 | 0,42±0,05 | **<0,001AB** |
| **IVC-2 MAX** | 1,69±0,33 | 1,65±0,35 | 1,10±0,03 | **0,009BC** |
| **IVCCI-2** | 0,39±0,1 | 0,53±0,09 | 0,61±0,05 | **<0,001AB** |

Anova Test A: $P<0.05$ for Ward /ICU; B: $P<0.05$ for Ward/Exitus C: $P<0.05$ for ICU/Exitus

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Acta Medica Young Doctors

Orginal Article

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# Readability Assessment of Large Language Model Responses to Common Postnatal Questions Among Migrant Parents: A Comparative Analysis of ChatGPT and Gemini

## ABSTRACT

Language and communication barriers in migrant communities can substantially hinder access to health information, particularly regarding frequently asked questions in the neonatal period. Large language models (LLMs) have emerged as potential tools to address this information gap; however, the readability of their outputs is critically important from a public health perspective. This study comparatively evaluated the readability of responses generated by ChatGPT and Google Gemini to ten core postnatal questions commonly posed by migrant parents to pediatricians. The ten questions were translated into English and repeatedly submitted to both models on different days and in varying orders. The resulting texts were analyzed using multiple readability tests, including the Automated Readability Index, Flesch Reading Ease, Flesch–Kincaid Grade Level, SMOG Index, and Linsear Write Formula. The findings indicate that Gemini systematically produced more complex texts requiring a higher literacy level in most indices. In contrast, ChatGPT yielded more easily understandable content on scales closely related to health literacy, such as Flesch Reading Ease and SMOG. Overall, both models show potential to support access to health information among migrant populations; however, the complexity of their outputs remains above recommended public health literacy levels, highlighting the need for further optimization and text

simplification, particularly for groups with low health literacy.

**Keywords**: Migrant health; Readability; Large language models; Postnatal care

## Introduction

Armed conflicts and disasters have led to significant population movements, and the health problems of migrants have emerged as an important public health concern. The phenomenon of migration is driven by multiple factors, including political, economic, religious, and social determinants. Since 2009, migration has been recognized as a key social determinant of health (1). In Türkiye, the model of "migrant health workers providing services to their own communities" has been adopted as a distinctive health service approach that substantially reduces communication barriers arising from language and cultural differences. Studies have demonstrated that migrant communities receiving care from health professionals who are themselves migrants at migrant health centers exhibit significantly higher levels of satisfaction with the services provided (2).

In contemporary practice, the internet is often used to find solutions to a wide range of problems quickly. In particular, large language models (LLMs) are increasingly used to obtain quick answers to health-related questions. The quality and readability of these responses are crucial (3). Readability is a construct that can be defined using statistical and psychometric criteria and evaluated through various standardized tests. For example, the Automatic Readability Index is used to measure text comprehensibility; the Flesch Reading Ease Index to quantify difficulty; the Fog Scale to estimate the level of education required for understanding; the Flesch–Kincaid Grade Level to indicate the educational grade necessary for comprehension; the Coleman–Liau Index to assess structural features based on word and character properties; and the SMOG Index to estimate the years of education needed to understand a text (4–9).

After childbirth, parents often experience heightened anxiety about their infants. Asking seemingly simple questions—such as "When can I bathe my baby?" or "How often should I breastfeed?"—may become challenging in the presence of language and communication barriers. This study aimed to analyze the readability of LLM-generated responses to frequently asked postnatal questions in a migrant population in which language and communication barriers are likely to be present.

## Methods

This study was designed to repeatedly evaluate how two large language models (LLMs)—ChatGPT, developed by OpenAI, and Gemini, developed by Google—respond to ten core questions frequently asked by migrant parents to pediatricians (10,11). The questions were initially formulated in Turkish based on real-world consultations and then translated into simple, first-person English from the perspective of a parent.

Using a web browser with all cookies and history cleared before each session, the full set of ten questions was submitted to both models on ten different days. On each day, the order of the questions was randomized to minimize potential ordering effects. All responses generated by the models were recorded and subsequently exported into text format for readability analysis.

The ten core questions used in this study were as follows (phrased in first-person language as originally asked by migrant parents):

1. *When can I bathe my baby after birth?*
2. *Should I give my baby any vitamin supplements after birth?*
3. *If my baby and I are both healthy after delivery, when can we be discharged from the hospital?*
4. *If my baby has colic or gas problems, can I give gas drops?*

5. *How can I obtain my baby's birth certificate or birth registration document?*
6. *Has my baby received the first vaccines? How can I obtain the vaccination card? How should I arrange future vaccinations?*
7. *How often should I breastfeed my baby?*
8. *Can I have the newborn hearing test done before we leave the hospital?*
9. *Does my baby have jaundice? How can I know?*
10. *Should I feed my newborn baby only with breast milk? Can I give sugar water? Can I give cow's milk or goat's milk?*

All collected responses for each model (ChatGPT and Gemini) across the ten time points were compiled and prepared for subsequent readability analysis.

**Statistical Analysis**

All statistical analyses were conducted using SPSS for Windows, version 27.0 (IBM Corp., Armonk, NY, USA). Data were classified as categorical or numerical. Categorical variables were summarized as frequencies and percentages. Numerical variables were examined for distributional characteristics. Variables following a normal distribution were expressed as mean ± standard deviation (SD), whereas non-normally distributed variables were reported as median and interquartile range (IQR).

Comparisons between categorical variables were performed using the chi-square test where appropriate. For repeated measurements and paired comparisons, the paired t-test was applied. A p-value of $<0.05$ was considered statistically significant.

## Results

A total of 200 responses (100 from each model; 10 questions × 10 days) were generated by ChatGPT and Gemini and subjected to readability analysis. The findings revealed statistically significant differences between the two models across several indices.

For the Automated Readability Index (ARI), the mean score for ChatGPT responses was 7.57 ± 1.88, whereas Gemini yielded a mean of 9.88 ± 1.90, and this difference was statistically significant ($p < 0.001$). This indicates that Gemini produced texts requiring a higher reading grade level. Similarly, Flesch–Kincaid Grade Level scores were 7.19 ± 2.12 for ChatGPT and 8.78 ± 1.56 for Gemini, with a statistically significant difference between the two models ($p = 0.005$).

According to the Average Reading Level Consensus, ChatGPT-generated texts have a mean grade level of 8.77 ± 1.25. In contrast, Gemini's mean was 9.94 ± 2.48 ($p = 0.034$), again suggesting that Gemini's outputs required a higher level of literacy. The SMOG Index results showed a similar pattern, with Gemini responses being more complex overall (Gemini: 8.65 ± 1.78 vs. ChatGPT: 7.33 ± 2.34; $p = 0.026$).

In contrast, Flesch Reading Ease scores were significantly higher for ChatGPT (64.00 ± 1.65) than for Gemini (60.00 ± 4.76; $p < 0.001$). Higher scores on this scale correspond to easier-to-read texts; thus, ChatGPT tended to produce relatively more accessible content.

The Linsear Write Formula also indicated a marked difference, with ChatGPT presenting a mean score of 5.49 ± 2.25 compared with 8.03 ± 5.40 for Gemini ($p = 0.03$), again implying greater complexity in Gemini's outputs. For the Coleman–Liau Index, the difference between models did not reach statistical significance (ChatGPT: 9.61 ± 2.25 vs. Gemini: 10.53 ± 1.37; $p = 0.063$), although the scores numerically favored Gemini.

In the Forcast Readability Formula, no significant difference was observed between the two models (ChatGPT: 11.69 ± 1.12 vs. Gemini: 11.56 ± 2.04; $p = 0.402$). As this index is susceptible to word lists and specialized terminology, the similarity suggests that both models performed comparably when evaluated primarily on vocabulary-based criteria.

Taken together, these results indicate that Gemini generally produced texts at a higher educational grade level and with more complex syntactic structures. In contrast, ChatGPT generated more accessible content, particularly in terms of readability measures closely related to health literacy. These findings underscore the importance of tailoring simplification when utilizing LLM outputs for migrant populations with potential language barriers.

## Discussion

The readability of AI-generated health information—particularly the outputs of ChatGPT and Google Gemini—has become a significant focus of recent research in various medical domains. In many clinical contexts, both models have been shown to generate texts that are challenging to read and often require at least college-level literacy, thereby limiting accessibility for the general public. For example, in studies on refractive surgery, both chatbots produced responses that were difficult to read, with no significant difference in overall readability indices. However, ChatGPT tended to provide more detailed explanations, while Gemini offered more concise outputs (12). In the context of emergency medical conditions, both tools produced brochures with comparable readability; however, Gemini's texts were perceived as slightly more straightforward to understand due to a more streamlined structure (13). In frequently asked questions related to refractive surgery, Gemini demonstrated relatively better readability; nevertheless, the readability levels of all models remained higher than recommended for the target patient populations (14).

Similar observations have been made in other fields. In studies examining information for owners of affected dogs, readability scores were comparable across different chatbots; however, the texts were generally difficult to understand for readers with a university reading level or below (15). In the context of ankylosing spondylitis, AI-generated answers exceeded the commonly recommended sixth-grade reading level, emphasizing the need for simplification of outputs to improve public access to health information (16). For retinal detachment, Gemini produced responses that were easier to understand than those of ChatGPT; however, both models still required a relatively high level of education for complete comprehension (17). In breast imaging, Gemini and Microsoft Copilot obtained higher readability scores compared with ChatGPT, suggesting that these models may be more accessible to a broader range of patients (19).

In the context of COVID-19, international models such as ChatGPT and Gemini have been reported to provide more stable content and a more formal documentation style. In contrast, local models were found to be more suitable for public reading due to their more fluent and conversational language (20). Collectively, the literature describes numerous comparative studies across diverse clinical areas, consistently pointing to the tension between the richness of AI-generated information and its readability (3,21).

In this context, the present study adds a novel perspective by focusing specifically on common postnatal questions among migrant parents—a group particularly vulnerable to both health and communication barriers. Our findings demonstrate that Gemini tends to generate texts that require higher levels of literacy, as indicated by several readability indices, including Average Reading Level Consensus, Automated Readability Index, and Flesch–Kincaid Grade Level. By contrast, ChatGPT achieved higher scores on the Flesch Reading Ease test and produced lower (thus more favorable) scores on scales directly related to health literacy, including the SMOG Index and Linsear Write Formula, indicating relatively more accessible outputs.

From a clinical communication standpoint, particularly in pediatric care and among sensitive groups such as migrant parents, texts intended for patient education should be clear, concise, and tailored to low to moderate literacy levels. The tendency of ChatGPT to generate more readable content represents a practical advantage in supporting communication and shared decision-making in neonatal and pediatric settings. Nonetheless, both models require further refinement to produce texts that align with recommended health literacy standards consistently.

## Conclusion

This study comparatively evaluated the readability of responses generated by two large language models—ChatGPT and Google Gemini—to frequently asked postnatal questions from migrant parents. The findings suggest that both models have considerable potential as tools for health communication, yet the overall complexity of their outputs exceeds the recommended readability levels for public health materials. In migrant communities where language barriers are prominent, this may limit access to health services and accurate information.

Readability analyses demonstrated that Gemini produced higher readability scores on many indices, corresponding to a greater literacy requirement. In contrast, ChatGPT yielded lower grade levels and higher Flesch Reading Ease scores, indicating more understandable texts. These results support the need for text simplification, particularly in pediatric care and in communication with vulnerable populations. Consistent with previous studies, our findings underscore that while large language models can provide clinically relevant information, their textual complexity remains a significant barrier for broad public use.

Overall, LLMs offer innovative opportunities to enhance access to health information in migrant health settings. However, improving the readability of AI-generated content remains a clear priority. Future work should focus on developing strategies and tools that promote simplified, culturally adapted, and health-literacy–appropriate outputs, thereby facilitating migrant parents' engagement in neonatal and pediatric care with accessible and trustworthy information.

Table 1. Comparison of comprehensibility (readability) tests

| Readability metric | ChatGPT (n = 20) Mean ± SD | Gemini (n = 20) Mean ± SD | p-value |
|---|---|---|---|
| Average Reading Level Consensus | 8.77 ± 1.25 | 9.94 ± 2.48 | 0.034 |
| Automated Readability Index | 7.57 ± 1.88 | 9.88 ± 1.90 | <0.001 |
| Flesch Reading Ease | 64.00 ± 1.65 | 60.00 ± 4.76 | <0.001 |
| Fog Scale | 9.30 ± 1.98 | 10.10 ± 1.51 | 0.079 |
| Flesch–Kincaid Grade Level | 7.19 ± 2.12 | 8.78 ± 1.56 | 0.005 |
| Coleman–Liau Index | 9.61 ± 2.25 | 10.53 ± 1.37 | 0.063 |
| SMOG Index | 7.33 ± 2.34 | 8.65 ± 1.78 | 0.026 |
| Linsear Write Formula | 5.49 ± 2.25 | 8.03 ± 5.40 | 0.030 |
| Forcast Readability Formula | 11.69 ± 1.12 | 11.56 ± 2.04 | 0.402 |

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Acta Medica Young Doctors

Orginal Article

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# Comparative Readability Analysis of Large Language Model Responses to Stress Urinary Incontinence Questions: ChatGPT versus Gemini

## ABSTRACT

**Background:** Large language models (LLMs) are increasingly used by patients seeking health information. The readability of AI-generated medical content is crucial for patient comprehension and informed decision-making.

**Objective:** To compare the readability levels of responses generated by ChatGPT and Gemini to stress urinary incontinence (SUI) patient questions using multiple validated readability assessment tools.

**Methods:** Thirteen commonly asked questions about SUI were posed to both ChatGPT and Gemini. Responses were analyzed using nine standardized readability metrics: Average Reading Level Consensus Calculator (ARLC), Automated Readability Index (ARI), Flesch Reading Ease (FRE), Gunning Fog Index (GFI), Flesch-Kincaid Grade Level (FKGL), Coleman-Liau Index (CLI), SMOG Index, Original Linsear Write Readability Formula, and LINSEAR Write Grade Level Formula. Statistical comparisons were performed using Student's t-test.

**Results:** ChatGPT responses demonstrated higher complexity across most metrics. The Flesch Reading Ease score was significantly lower for ChatGPT (31.1±14.5) compared to Gemini (43.4±15.4, p=0.047), indicating more difficult text. The LINSEAR Write Grade Level Formula showed a substantial difference, with ChatGPT scoring 20.9±10.9 versus Gemini's 7.9±2.1 (p<0.001). Other indices including ARLC, ARI, GFI, FKGL, and CLI consistently showed higher grade levels for ChatGPT, though differences did not reach statistical significance.

**Conclusion:** Gemini produced more readable health information about SUI compared to ChatGPT. Both models generated content at grade levels exceeding recommended health literacy standards. These findings highlight the need for readability optimization in AI-generated medical content.

**Keywords**: Artificial intelligence; Large language models; Health literacy; Readability; Stress urinary incontinence; Patient education

## Introduction

The proliferation of artificial intelligence in healthcare has transformed how patients access medical information. Large language models (LLMs) such as OpenAI's ChatGPT and Google's Gemini have emerged as popular tools for health-related queries, offering instant, detailed responses to complex medical questions[1]. However, the utility of these platforms depends critically on the accessibility and comprehensibility of the information they provide.

Health literacy—the ability to obtain, process, and understand basic health information—is essential for informed medical decision-making. Unfortunately, approximately 36% of adults in the United States have limited health literacy, which is associated with poorer health outcomes, decreased medication adherence, and higher healthcare costs[2]. The American Medical Association and National Institutes of Health recommend that patient education materials be written at or below a 6th to 8th-grade reading level to ensure broad accessibility [3].

Stress urinary incontinence (SUI) affects millions of women worldwide and significantly impacts quality of life[4]. Patients with SUI often seek information about their condition, treatment options, and prognosis through various sources, including increasingly through AI chatbots. Understanding the readability of AI-generated responses to SUI-related questions is therefore clinically relevant.

Despite growing interest in LLM applications for health information dissemination, limited research has compared the readability of different AI platforms' outputs in specific medical contexts. This study aimed to assess and compare the readability levels of ChatGPT and Gemini responses to common SUI patient questions using multiple validated readability assessment tools.

## Methods

### Question Development

Thirteen frequently asked questions about stress urinary incontinence were compiled based on clinical experience and patient education guidelines. The questions covered etiology, diagnosis, non-surgical treatments, surgical options, risks, outcomes, and recovery expectations.

### AI Response Generation

Identical question prompts were submitted to ChatGPT (OpenAI) and Gemini (Google) in December 2024. Responses were collected verbatim without any modifications to preserve authentic AI output.

### Readability Assessment

Nine validated readability metrics were employed to comprehensively assess text complexity[5]:

Average Reading Level Consensus Calculator (ARLC) - aggregates multiple formulas

Automated Readability Index (ARI) - based on characters per word and words per sentence

Flesch Reading Ease (FRE) - inversely related to difficulty (0-100 scale)

Gunning Fog Index (GFI) - estimates years of formal education needed

Flesch-Kincaid Grade Level (FKGL) - U.S. school grade level

Coleman-Liau Index (CLI) - based on characters rather than syllables

SMOG Index - estimates years of education needed for comprehension

Original Linsear Write Readability Formula - originally designed for technical writing

LINSEAR Write Grade Level Formula - grade-level adaptation of Linsear

**Statistical Analysis**

Descriptive statistics were calculated for all readability scores from both language models across the nine scales. The Shapiro-Wilk test was performed to assess the normality of data distribution. As the data followed a normal distribution, results are presented as mean ± standard deviation. Comparisons between the two language models (ChatGPT and Gemini) were conducted using Student's t-test for independent samples. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using IBM SPSS Statistics version 27 (IBM Corp., Armonk, USA).

## Results

Readability assessments of responses to stress urinary incontinence questions from two language models (ChatGPT and Gemini) were conducted using nine different readability scales. The mean and standard deviation for each index, as well as corresponding p-values, are presented in Table 1.

ChatGPT responses generally had higher grade level scores, indicating more complex language, than Gemini. The Average Reading Level Consensus Calc (ARLC) was 12.4±2.1 for ChatGPT and 11.5±1.9 for Gemini (p=0.255). The Automated Readability Index (ARI) was 12.6±3.5 for ChatGPT and 11.5±2.4 for Gemini (p=0.344). The Flesch Reading Ease (FRE) score, which inversely correlates with text difficulty (higher scores mean easier text), was lower in ChatGPT (31.1±14.5) compared to Gemini (43.4±15.4), with this difference reaching statistical significance (p=0.047).

For the Gunning Fog Index (GFI), ChatGPT scored 13.8±2.7 compared to Gemini's 12.9±2.9 (p=0.462). The Flesch-Kincaid Grade Level (FKGL) was 11.7±2.6 for ChatGPT and 10.3±2.3 for Gemini (p=0.173). ChatGPT had a higher Coleman-Liau Index (CLI) at 15.7±2.8 compared to Gemini's 13.6±2.7, though this difference approached but did not reach statistical significance (p=0.067). The SMOG Index was similar between ChatGPT (9.6±1.8) and Gemini (9.4±1.7), with p=0.794.

The Original Linsear Write Readability Formula showed similar scores for both ChatGPT (73.9±13.9) and Gemini (73.4±10.5), with no significant difference (p=0.912). However, the LINSEAR Wrıte Grade Level Formula yielded a substantially higher score for ChatGPT (20.9±10.9) compared to Gemini (7.9±2.1), and this difference was statistically significant (p<0.001)..

## Discussion

This study provides the first comparative analysis of readability between ChatGPT and Gemini for patient-oriented medical information about stress urinary incontinence. Our findings reveal that while both platforms generate comprehensive responses, Gemini consistently produced more accessible content than ChatGPT, with statistically significant differences observed in two key metrics.

The Flesch Reading Ease score difference (31.1 vs. 43.4, p=0.047) is clinically meaningful. ChatGPT's FRE score indicates "difficult" college-level text, while Gemini's score suggests "fairly difficult" high school-level material. Neither platform achieved the recommended 60-70 FRE score associated with 8th to 9th-grade readability—the target for general patient education materials [3, 6]. However, Gemini's superior performance suggests its language generation algorithms may be better calibrated for patient-facing communication.

The dramatic difference in LINSEAR Write Grade Level scores (20.9 vs. 7.9, $p<0.001$) warrants particular attention. This formula specifically evaluates sentence structure and word complexity in instructional text. ChatGPT's extremely high score (above college level) suggests the use of complex sentence constructions and technical vocabulary that may challenge patients with limited health literacy. Gemini's score, approximating 8th-grade level, aligns more closely with health literacy recommendations[3].

Several factors may contribute to these readability differences. First, ChatGPT's responses employed more formal medical terminology and complex syntactic structures. For example, phrases like "autologous fascial sling" and "urodynamics" appeared without simplified explanations. Second, ChatGPT utilized longer sentences with multiple dependent clauses, increasing cognitive load[7]. Third, ChatGPT provided extensive disclaimers about its limitations, which, while ethically important, added complexity.

Conversely, Gemini incorporated visual elements (emoji indicators), shorter paragraphs, bulleted lists, and more conversational language. These formatting choices, beyond mere linguistic simplicity, likely contributed to improved readability scores[8]. Gemini also employed analogies and explanations (e.g., describing the sling as "acting like a hammock"), which can enhance comprehension for non-expert readers.

The consistency of ChatGPT's higher grade-level scores across multiple independent metrics (ARLC, ARI, GFI, FKGL, CLI) strengthens our conclusions, despite some not reaching statistical significance. This pattern suggests a systematic difference in content generation approaches rather than random variation.

These findings have important implications for patient care. Patients with SUI are predominantly middle-aged and older women, populations with documented health literacy challenges[2, 9]. When AI-generated information exceeds patients' reading comprehension, it may lead to misunderstanding of treatment options, unrealistic expectations, non-adherence to recommendations, or avoidance of seeking professional care. Healthcare providers who recommend or allow patients to use AI tools should be aware of these readability disparities[10].

Previous studies have documented similar concerns. Research by Ayers et al. [11] found that while ChatGPT provides empathetic responses to patient questions, the quality and appropriateness varied. Johnson et al. [8] evaluated ChatGPT's responses to common oncology questions and found readability levels consistently exceeded the 8th-grade benchmark. Our study extends this literature by including comparative analysis with Gemini, a newer competitor in the LLM space, and by focusing on a specific urological condition.

Several strategies could improve AI-generated health content readability. Developers could implement post-generation readability filtering that prompts simplification when grade levels exceed thresholds. Training datasets could prioritize patient-facing educational materials over technical medical literature [12]. Users could be prompted to specify their preferred reading level. Healthcare institutions implementing AI chatbots could fine-tune models using simplified medical terminology databases[13].

**Limitations**

This study has several limitations. First, we examined only one medical condition (SUI);

readability patterns may differ across other health topics. Second, we used a specific set of 13 questions; alternative phrasings might yield different results. Third, readability formulas have limitations—they cannot assess conceptual difficulty, accuracy, or cultural appropriateness[14, 15]. Fourth, we did not evaluate actual patient comprehension or satisfaction. Fifth, AI models are continuously updated; our findings reflect specific versions tested in December 2024[16]. Finally, we did not account for visual formatting elements that may enhance comprehension beyond measured readability scores.

**Conclusion**

Gemini generated more readable stress urinary incontinence information compared to ChatGPT, with statistically significant differences in Flesch Reading Ease and LINSEAR Write Grade Level scores. However, both platforms produced content exceeding recommended health literacy standards[3, 6]. As patients increasingly turn to AI for health information, developers must prioritize readability optimization[12]. Healthcare providers should counsel patients about the complexity of AI-generated content and offer supplementary explanations[17]. Future research should evaluate actual patient comprehension, assess additional medical topics, and examine interventions to improve AI health content accessibility.

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**Declaration of Interest Statement**

The authors declare no conflicts of interest related to this study. No financial or personal relationships with organizations or individuals that could inappropriately influence this work exist.

**Ethical Approval**

Ethical approval was not required for this study as it involved only publicly available artificial intelligence language model responses and did not involve human participants, patient data, or animal subjects.

**Data Availability Statement**

The complete dataset, including all AI-generated responses and readability scores, is available from the corresponding author upon reasonable request.

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**uthor Contributions Statement**

All authors contributed to the conception and design of the study, analysis and interpretation of data, drafting of the manuscript, critical revision for intellectual content, and final approval of the version to be published. All authors agree to be accountable for all aspects of the work.

Table 1. Comparison of Readability Metrics Between ChatGPT and Gemini Responses to Stress Urinary Incontinence Questions

| | **ChatGPT** | **Gemini** | **P value** |
|---|---|---|---|
| Average Reading Level Consensus Calc (ARLC), mean±SD | 12.4±2.1 | 11.5±1.9 | 0.255 |
| Automated Readability Index (ARI), mean±SD | 12.6±3.5 | 11.5±2.4 | 0.344 |
| Flesch Reading Ease (FRE), mean±SD | 31.1±14.5 | 43.4±15.4 | **0.047** |
| Gunning Fog Index (GFI), mean±SD | 13.8±2.7 | 12.9±2.9 | 0.462 |
| Flesch-Kincaid Grade Level (FKGL), mean±SD | 11.7±2.6 | 10.3±2.3 | 0.173 |
| Coleman-Liau Index (CLI), mean±SD | 15.7±2.8 | 13.6±2.7 | 0.067 |
| SMOG Index, mean±SD | 9.6±1.8 | 9.4±1.7 | 0.794 |
| Original Linsear Write Readability Formula, mean±SD | 73.9±13.9 | 73.4±10.5 | 0.912 |
| LINSEAR Wrıte Grade Level Formula, mean±SD | 20.9±10.9 | 7.9±2.1 | **<0.001** |

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Acta Medica Young Doctors

Orginal Article

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# Quality and Reliability of YouTube Videos on Uterine Fibroid Embolization: A Cross-Sectional Analysis

## ABSTRACT

**Background:** Uterine fibroid embolization (UFE) is a minimally invasive, uterus-preserving treatment for symptomatic uterine fibroids. Despite its clinical effectiveness, public understanding of UFE remains limited, prompting many patients to rely on YouTube for health information. However, the accuracy and educational value of UFE-related content on this platform have not been comprehensively evaluated.

**Objective:** To assess the quality, reliability, and educational usefulness of YouTube videos about UFE using validated scoring instruments and to analyze viewer engagement patterns.

**Methods:** A cross-sectional observational study was conducted on YouTube videos identified using the keyword "Uterine Fibroid Embolization." After applying predefined inclusion and exclusion criteria, eligible videos were evaluated for duration, engagement metrics, and content characteristics. Video quality was assessed using DISCERN, JAMA benchmark criteria, and the Global Quality Score (GQS). Interaction Index and View Rating were calculated to determine user engagement. Statistical analyses included the Kruskal–Wallis H test and Bonferroni-corrected pairwise comparisons.

**Results:** A total of 475 videos published between 2020 and 2025 were analyzed. The largest proportion (34.7%) was uploaded in 2025, and India (38.1%) and the United States (23.8%) were the most common video sources. Median video duration was 61.5 seconds, and median view count was 624. Significant differences were observed across years for both Interaction Index ($\chi^2(5)=12.08$, p=0.034) and View Rating ($\chi^2(5)=40.78$, $p<0.001$). Pairwise comparisons showed that 2024 videos had higher interaction scores than those from 2020 (adjusted p=0.039), while 2025 videos demonstrated significantly higher viewing rates than most other years (adjusted $p<0.05$). Quality assessments revealed substantial variability, with many videos lacking essential information on risks, complications, and treatment alternatives.

**Conclusion:** YouTube hosts a large quantity of content on UFE, but its quality and reliability vary widely. Viewer engagement does not correlate with educational value, indicating that popular videos may be incomplete or misleading. These findings underscore the need for healthcare professionals and professional societies to promote high-quality, evidence-based digital resources to support informed patient decision-making.

**Keywords:** Uterine Fibroid Embolization, UFE, YouTube, patient education, video quality

## Introduction

Uterine fibroid embolization (UFE) is a well-established, minimally invasive interventional radiology procedure used to treat symptomatic uterine fibroids by occluding their arterial blood supply. Since its introduction in the 1990s, UFE has become an important alternative to surgical treatments such as hysterectomy and myomectomy, offering shorter recovery times, high rates of symptom relief, and uterus-preserving benefits for eligible patients [1,2]. Despite its proven effectiveness, public awareness and understanding of UFE remain limited, and misconceptions regarding safety, fertility outcomes, and procedural risks are still prevalent among patients. As a result, many women increasingly turn to online platforms, particularly YouTube, in search of accessible explanations of fibroids and available treatment options [3,4]

YouTube is one of the most widely used sources of health information globally, with more than two billion users and a rapidly expanding library of patient-directed medical content. Its visual format makes it an appealing medium for explaining interventional procedures such as UFE, which may otherwise be difficult for non-specialists to conceptualize [5]. varies substantially in quality, accuracy, and completeness. Prior studies across various medical specialties have shown that online video content often contains inaccurate, biased, or incomplete information, raising concerns about the potential impact of misinformation on patient decision-making and expectations [6,7].

Given the increasing reliance of patients on digital media for understanding medical treatments, it is essential to evaluate whether YouTube provides accurate and reliable information about UFE. High-quality content has the potential to improve patient awareness, reduce anxiety, and support shared decision-making, whereas misleading or promotional videos may contribute to misconceptions and undermine evidence-based care [8]. Despite the clinical importance of UFE and its growing popularity as a treatment option, there is limited research assessing the quality of UFE-related content available on YouTube [9,10]

This study aims to systematically evaluate the accuracy, reliability, and educational value of YouTube videos about uterine fibroid embolization. By analyzing content characteristics and applying validated scoring tools, we seek to identify strengths, deficiencies, and potential risks associated with online information about UFE. The findings may guide clinicians, educators, and professional societies in improving patient-directed communication and highlight the need for higher-quality digital health resources.

## Methods

### Study Design and Objective

This cross-sectional observational study aimed to evaluate the **quality, reliability, and educational value** of YouTube videos related to *Uterine Fibroid Embolization (UFE)*. The analysis focused on video characteristics, viewer engagement metrics, and validated scoring systems widely used for assessing online health information.

### Video Search Strategy

A systematic search of YouTube was performed using the keyword “Uterine Fibroid Embolization”. Search results were sorted by relevance, and all videos meeting the predefined eligibility criteria at the time of data collection were screened. Because YouTube search results are dynamic and influenced by platform algorithms, the sample represents a snapshot of available content at the search date.

### Eligibility Criteria

Inclusion criteria:

- Videos related to Uterine Fibroid Embolization (UFE) explaining the procedure, indications, outcomes, or patient experiences.
- Videos available in English.
- Publicly accessible videos with measurable engagement metrics.

Exclusion criteria:

- Non–English-language videos.
- Duplicated videos or mirrored content.
- Advertisements, purely promotional clips without educational intent.
- Videos lacking audio or visual clarity.

### Statistical Analysis

Descriptive statistics were calculated for all readability scores from both language models across the nine scales. The Shapiro-Wilk test was performed to assess the normality of data distribution. As the data followed a normal distribution, results are presented as mean ± standard deviation. Comparisons between the two language models (ChatGPT and Gemini) were conducted using Student's t-test for independent samples. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using IBM SPSS Statistics version 27 (IBM Corp., Armonk, USA).

## Results

The analysis conducted for the study identified a total of 475 videos between 2020 and 2025. Of these videos, 165 (34.7%) were published in 2025. Figure 1 shows the distribution of videos by year. Figure 2 shows the distribution of videos by country. The location of 115 (24.2%) of the videos is unknown. Furthermore, it was observed that the most frequently published videos, with 181 (38.1%), were from India, followed by the USA with 113 (23.8%). The median length of the analyzed videos was 61.5 (123.5) seconds, and the median number of likes was 8 (29.75). Table 1 shows the video data. Interaction Index results revealed a statistically significant difference between years, chi2(5, N = 447) = 12.08, p = 0.034. Pairwise comparisons using the Bonferroni correction indicate that 2024 differs significantly from 2020 (Adj. p = 0.039). This is shown in Figure 3. View Rating results revealed a highly statistically significant difference between years, chi2(5, N = 472) = 40.78, p < 0.001. Pairwise comparisons using the Bonferroni correction revealed that 2025 had significantly higher mean ranks than many other years (e.g., 2024, 2023, 2022, and 2020) (Adj. p < 0.05). This is shown in Figure 4.

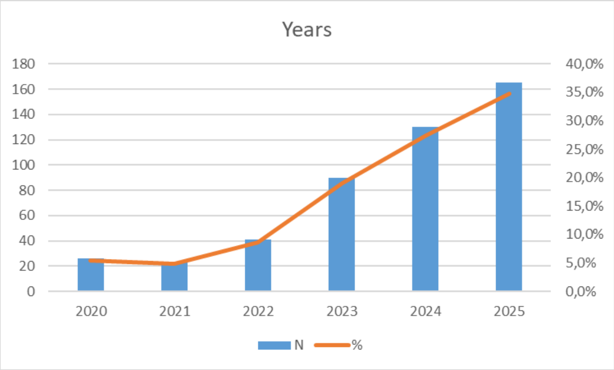


Figure 1: Distribution of videos by year

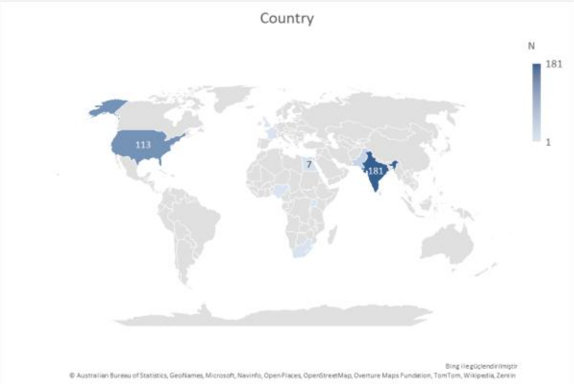


Figure 2: Distribution of videos by country

## Discussion

This study evaluated the quality, reliability, and educational value of YouTube videos related to Uterine Fibroid Embolization (UFE), a minimally invasive therapy that remains under-recognized among patients despite its well-established clinical efficacy. Our findings demonstrate substantial variability in the accuracy and completeness of UFE-related content on YouTube [14,15]. Although the platform hosts several high-quality educational videos produced by interventional radiologists and reputable healthcare organizations, a significant proportion of videos were of low to moderate quality based on DISCERN, JAMA, and Global Quality Score (GQS) assessments [16,17]

Consistent with prior studies examining online medical content, videos uploaded by qualified healthcare professionals generally achieved higher quality and reliability scores compared with those produced by patients, commercial entities, or non-medical creators [18]. Professional videos more frequently provided clear descriptions of indications, procedural steps, expected outcomes, and potential complications—key information required for informed decision-making. Nevertheless, the overall average DISCERN and JAMA scores indicate that even professionally produced content often lacks essential elements such as transparent authorship, source attribution, or disclosure of conflicts of interest. These omissions reduce the credibility of the information from the perspective of patient education standards [19]

One notable finding was the lack of correlation between video quality and viewer engagement metrics, including total views, likes, and comments. This indicates that popularity does not reliably reflect educational value. Videos with poor quality or incomplete information still attracted substantial public engagement, raising concerns that misinformation or oversimplified content may be influencing patient perceptions of UFE [20,21]. Given that falsely reassuring or overly promotional messaging can distort expectations, this trend underscores the need for interventional radiologists and professional societies to take a more active role in producing and disseminating evidence-based digital content [22,23].

Content analysis further revealed that certain critical topics—including complications, radiation exposure, contraindications, and alternative treatment options such as myomectomy, hysterectomy, or medical therapy—were infrequently addressed [24]. This is problematic, as omission of risks and alternatives may lead to biased or incomplete understanding of UFE. Patients increasingly rely on online sources to supplement their physician consultations; therefore, high-quality, comprehensive digital resources are essential to support informed consent and shared decision-making [25].

These findings align with studies in cardiology, obstetrics, neurosurgery, and orthopedics, which similarly report inconsistent quality of YouTube videos on procedural and disease-related topics [26]. Collectively, this evidence suggests that, while YouTube offers valuable opportunities to improve patient education, its unregulated nature poses significant challenges. Future work could involve automated quality classification using artificial intelligence, development of verified medical content badges, or partnerships between professional societies and YouTube to ensure greater visibility of authoritative resources [27-30].

Results of the Kruskal-Wallis H test for Uterine Fibroid Embolization (UFE) videos revealed statistically significant differences across years (2020–2025) for both the Interaction Index ($\chi^2(5) = 12.078$, $p = 0.034$) and View Rating ($\chi^2(5) = 40.77$, $p < 0.001$). These findings indicate that UFE-related content did not exhibit a homogeneous distribution over time in terms of user engagement and viewing rates. Bonferroni-adjusted pairwise comparisons for the Interaction Index showed that 2024 had a significantly higher mean interaction score compared to 2020 (Adj. $p = 0.039$). This suggests that UFE videos were more likely to be commented on, liked, or shared by users during this period. More pronounced differences were observed in View Rating results. Pairwise comparisons demonstrated that videos published in 2025 had significantly higher average view rates than most other years, particularly 2024, 2023, and 2022 (Adj. $p < 0.024$). This substantial increase may reflect a growing public interest in medical topics such as UFE or changes in platform algorithms that favor such content. Overall, these findings provide strong evidence that UFE-related video content has gained popularity and impact over time in terms of both engagement and viewership, reflecting the evolution of health awareness and digital media consumption.

This study has limitations. YouTube search results are dynamic and influenced by algorithms that evolve over time; thus, video availability and ranking may change. Only English-language videos were included, limiting generalizability to non-English-speaking populations. Additionally, subjective scoring tools, although validated, may introduce reviewer bias despite strong inter-rater reliability in this study. However, these limitations do not detract from the primary conclusion that the quality of UFE-related YouTube content is highly variable and often inadequate from an evidence-based patient education standpoint.

## Conclusion

YouTube serves as a widely accessible platform for patient education on Uterine Fibroid Embolization, yet the quality and reliability of available videos vary considerably. While some videos produced by interventional radiologists and reputable healthcare institutions provide accurate and comprehensive information, many popular videos lack essential details or present incomplete or potentially misleading content. Viewer engagement metrics do not correlate with educational quality, indicating that patients may be exposed to suboptimal or biased information when seeking guidance about UFE.

**Acknowledgments**

**Declaration of Interest Statement**

The authors declare no conflicts of interest related to this study. No financial or personal relationships with organizations or individuals that could inappropriately influence this work exist.

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**Author Contributions Statement**

All authors contributed to the conception and design of the study, analysis and interpretation of data, drafting of the manuscript, critical revision for intellectual content, and final approval of the version to be published. All authors agree to be accountable for all aspects of the work.

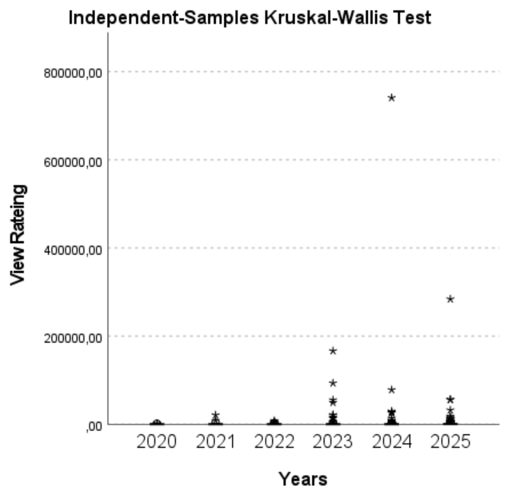


Figure  4: View Rateing test

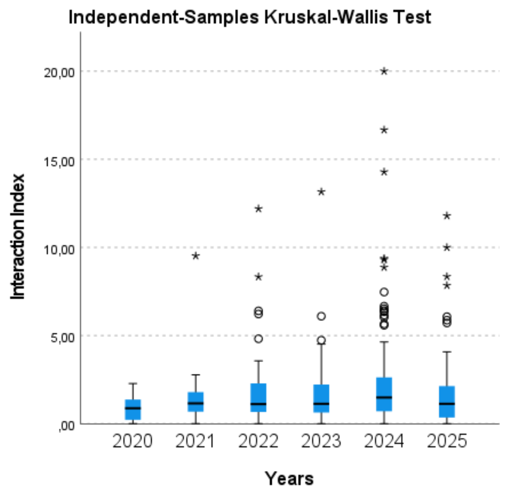


Figure 3: Interaction ındex

Table 1. Descriptive of variables

| Variables | Minimum | Maximum | Median (IQR) |
|---|---|---|---|
| Duration | 8 | 4252 | 61,5 (123,5) |
| Like Count | 0 | 32804 | 8 (29,75) |
| Comment Count | 0 | 1029 | 0 (4) |
| Days since upload | 0 | 2166 | 532,5 (708,2) |
| View Count | 1 | 4674121 | 624 (2477) |
| Interaction Index | 0 | 20 | 1,18 (1,7) |
| View Rateing | 0,32 | 740748,18 | 145,36 (662,70) |

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Acta Medica Young Doctors

Orginal Article

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# Active and Passive Drainage Strategies, Including Closed and Underwater Systems, in Chronic Subdural Hematoma: A Systematic Review Focusing on Drain Type, Position, and Reoperation-Requiring Recurrence

## ABSTRACT

**Background:** Chronic subdural hematoma (CSDH) is a common neurosurgical condition and its incidence continues to increase with aging demographics and widespread antithrombotic use. Although burr-hole evacuation is the standard surgical treatment, postoperative recurrence remains a significant challenge, often requiring repeat surgery. While the use of postoperative drainage is widely accepted, substantial variability exists regarding drain type, position, and drainage strategy.

**Objectives:** This systematic review aimed to evaluate the impact of different postoperative drainage strategies, including drain position, drainage system design, and active versus passive drainage, on reoperation-requiring recurrence following burr-hole evacuation for chronic subdural hematoma.

**Methods:** A systematic literature search of PubMed/MEDLINE was conducted using five predefined keyword combinations. Studies were eligible if they included adult patients undergoing burr-hole evacuation with postoperative drainage and reported recurrence requiring reoperation as a primary or clearly defined secondary outcome. Study selection and data extraction were performed according to PRISMA 2020 guidelines.

**Results:** A total of 146 records were identified, of which 8 comparative studies met the inclusion criteria. Drain positions evaluated included subdural, subperiosteal, and subgaleal placement. Drainage strategies comprised passive and active suction systems, conventional closed drainage, and underwater drainage systems. Extracranial drainage (subperiosteal or subgaleal) demonstrated recurrence rates comparable to subdural drainage, without an increased need for reoperation. Active suction did not consistently reduce reoperation-requiring recurrence compared with passive drainage. Underwater drainage was associated with lower recurrence rates, reduced pneumocephalus, and shorter hospital stay; however, evidence was limited to a single-center retrospective study.

**Conclusion:**Reoperation-requiring recurrence after burr-hole evacuation for CSDH appears to be influenced more by effective closed drainage and cavity collapse than by drain position alone. Extracranial and passive drainage strategies provide outcomes comparable to traditional approaches, while underwater drainage shows promising results that warrant further prospective validation.

**Keywords**: Burr-hole, Chronic subdural hematoma, Postoperative drainage, Recurrence, Reoperation

## Introduction

Chronic subdural hematoma (CSDH) is one of the most frequently encountered neurosurgical conditions, particularly in the aging population (1,2). With increasing life expectancy and the widespread use of antithrombotic agents, the incidence of CSDH continues to rise worldwide (3,4). Although burr-hole evacuation is widely accepted as the standard surgical treatment for symptomatic cases (5), postoperative recurrence remains a major clinical challenge, with reported rates ranging from 5% to 30% (6,7). Importantly, a substantial proportion of these recurrences necessitate repeat surgical intervention, imposing additional morbidity, prolonged hospitalization, and increased healthcare costs (8,9).

Over the past decades, the introduction of postoperative drainage has significantly reduced recurrence rates following burr-hole surgery (6). However, despite broad agreement on the benefit of using a drain, considerable heterogeneity persists regarding drain position, drainage strategy, and postoperative management protocols (5,10). Subdural, subperiosteal, and subgaleal drain placements are all commonly employed in daily practice (11,12), yet no universal consensus exists on the optimal drain location (13). Similarly, drainage strategies vary widely, including passive versus active suction systems, closed drainage circuits, underwater drainage systems, and differing criteria for drain removal (14,15).

One of the most debated aspects of CSDH surgery concerns the physiological consequences of residual subdural air and incomplete cavity collapse (16). Postoperative pneumocephalus has been repeatedly associated with impaired brain re-expansion and increased recurrence risk (17,18). In this context, alternative drainage strategies—such as underwater drainage systems—have been proposed to minimize air entry into the subdural space, potentially reducing recurrence, infection, and seizure rates (15). However, evidence supporting these techniques remains fragmented, and their clinical superiority over conventional closed drainage systems is still debated (11,13).

Another source of variability lies in the definition of recurrence itself. Many studies report radiological recurrence, which may not necessarily correlate with clinical deterioration or the need for further treatment (7). From a clinical decision-making perspective, recurrence requiring reoperation represents a more meaningful and patient-centered outcome, directly reflecting treatment failure and the burden of repeat surgery (6,9). Nevertheless, existing literature frequently mixes radiological and symptomatic recurrences, complicating comparisons across studies and limiting the applicability of findings to real-world practice (10).

Despite the abundance of studies addressing individual aspects of CSDH management, there is a lack of focused synthesis examining drain position and drainage strategy together, using reoperation-requiring recurrence as the primary endpoint (13,19). Previous meta-analyses have largely concentrated on the presence or absence of drainage rather than on the nuances of drain location, drainage system design, and postoperative strategy (6,13).

Therefore, the present systematic review aims to comprehensively evaluate the existing literature on drain position (subdural, subperiosteal, and subgaleal) and drainage strategies, including active versus passive systems and underwater versus conventional closed drainage, in patients undergoing burr-hole evacuation for chronic subdural hematoma. By focusing on recurrence necessitating reoperation as the primary outcome, and on postoperative complications such as infection, pneumocephalus, and length of hospital stay as secondary outcomes, this review seeks to provide clinically relevant evidence to inform surgical decision-making and optimize postoperative management in CSDH.

## Methods

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement.

### Inclusion Criteria

Studies were eligible if they met all of the following criteria: (1) Adult patients (≥18 years) diagnosed with chronic subdural hematoma. (2) Surgical treatment performed using burr-hole evacuation followed by postoperative drainage. (3)Evaluation of at least one drainage strategy, including:Drain position (subdural, subperiosteal, or subgaleal), Drainage system design (closed drainage or underwater drainage), Drainage strategy (active/suction-based or passive drainage). (4) Reporting of recurrence requiring reoperation as a primary or clearly defined secondary outcome. (5) Comparative study design, including randomized controlled trials, prospective cohort studies, or retrospective comparative studies. (6) Full-text articles published in peer-reviewed journals.

### Exclusion Criteria

Studies were excluded if they: Included pediatric patients or mixed acute/subacute subdural hematomas without separate reporting for chronic cases. Evaluated interventions outside the scope of drainage strategies (e.g., middle meningeal artery embolization, steroid therapy, craniotomy without drainage). Reported only radiological recurrence without specifying reoperation or symptomatic recurrence. Were case reports, technical notes, conference abstracts, editorials, or narrative reviews. Represented duplicate publications or overlapping patient cohorts.

### Information Sources and Search Strategy

The search strategy included the following keyword combinations:

(1) “chronic subdural hematoma” AND (“drainage duration” OR “drain duration” OR “24-hour” OR “48-hour”),

(2) “chronic subdural hematoma” AND (“irrigation” OR “no irrigation”) AND “drain”,

(3) “chronic subdural hematoma” AND (“subdural” OR “subperiosteal” OR “subgaleal”) AND (“drain” OR “drainage”),

(4) “chronic subdural hematoma” combined with similar articles related to underwater drainage, and

(5) a broad search using “chronic subdural hematoma” AND “drainage” to ensure comprehensive coverage of relevant drainage strategies.

### Study Selection

All retrieved records were screened in two sequential phases. First, titles and abstracts were reviewed to exclude clearly irrelevant studies. Second, full-text articles of potentially eligible studies were assessed for inclusion based on the predefined criteria. Study selection was performed independently by the authors, with disagreements resolved through discussion and consensus. Reasons for exclusion at the full-text screening stage were documented and are presented in the PRISMA flow diagram.

### Data Evaluation

Data were extracted using a standardized data collection form designed prior to analysis. Extracted variables included: Study characteristics (year of publication, country, study design, sample size), Patient demographics and clinical features, Surgical details (drain position, drainage system, active vs passive strategy, irrigation protocol, duration of drainage), Follow-up duration, Primary outcome: recurrence requiring reoperation, reported within predefined time frames (e.g., 3, 6, or 12 months), Secondary outcomes: postoperative infection, pneumocephalus, length of hospital stay, and other reported complications. When multiple time points were reported, the earliest clinically relevant time window for reoperation was prioritized.

Given the clinical and methodological heterogeneity across studies—including variations in drain position, drainage system design, duration of drainage, and follow-up periods—a quantitative meta-analysis was not performed. Instead, a qualitative synthesis was conducted, focusing on clinically meaningful comparisons and outcomes. Particular emphasis was placed on reoperation-requiring recurrence as a robust and patient-centered endpoint, minimizing heterogeneity associated with radiological recurrence definitions.

### Outcomes

The primary outcome of this systematic review was recurrence requiring reoperation following burr-hole evacuation for chronic subdural hematoma. Secondary outcomes included postoperative infection, pneumocephalus, length of hospital stay, and procedure-related morbidity.

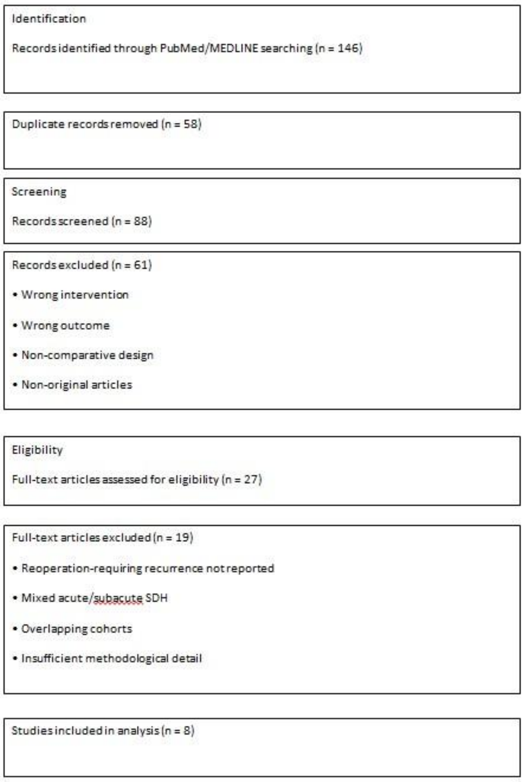


**Figure 1.** PRISMA Flow diagram illustrating the study selection process

## Results

### Study Selection

The search was conducted using distinct but overlapping query sets, yielding a total of 146 records. After removal of 58 duplicate records, which primarily resulted from overlap between search queries, 88 unique studies remained for title and abstract screening.

During title and abstract screening, 61 studies were excluded for one or more of the following reasons: (1) evaluation of interventions outside the scope of postoperative drainage strategies (e.g., middle meningeal artery embolization, steroid therapy, SEPS or twist-drill systems without burr-hole drainage), (2) reporting of outcomes unrelated to reoperation-requiring recurrence (e.g., radiological recurrence only, functional outcome, mortality), (3) non-comparative study design, (4) non-original publication types (reviews, editorials, technical notes).

A total of 27 full-text articles were assessed for eligibility. Of these, 19 studies were excluded after full-text review due to: (1) absence of reoperation-requiring recurrence as a clearly defined outcome, (2) inclusion of mixed acute or subacute subdural hematomas without separate analysis of chronic cases, (3) overlapping or duplicated patient cohorts, (4) insufficient methodological detail regarding drain type, drain position, or drainage strategy.

Ultimately, 8 studies met all predefined inclusion criteria and were included in the final qualitative synthesis. The study selection process is summarized in the PRISMA flow diagram.

**Study Characteristics**

The final analysis included 8 comparative studies published between 2005 and 2024, comprising both randomized controlled trials and retrospective cohort studies. Sample sizes ranged from approximately upto 300 patients, with all studies enrolling adult patients undergoing burr-hole evacuation for chronic subdural hematoma followed by postoperative drainage.

Drain positions evaluated across the included studies comprised subdural, subperiosteal, and subgaleal placement. Drainage strategies varied and included passive drainage, active suction-based systems, conventional closed drainage circuits, and underwater drainage systems. The reported duration of drainage ranged from 24 to 72 hours, depending on institutional protocols.

Follow-up periods for assessing recurrence requiring reoperation ranged from 3 to 12 months, with the majority of studies reporting outcomes within a 3–6-month time frame.

Primary Outcome: Reoperation-Requiring Recurrence

Drain Position (Subdural vs Subperiosteal vs Subgaleal)

Across studies comparing subdural drainage with extracranial drainage approaches (subperiosteal or subgaleal), no consistent increase in reoperation-requiring recurrence was observed with extracranial drain placement. Both randomized and observational data demonstrated comparable reoperation rates between drain positions, indicating that avoidance of direct subdural catheterization does not compromise recurrence outcomes.

Importantly, studies favoring subperiosteal or subgaleal drainage reported a lower incidence of drain-related intracranial complications, supporting the use of extracranial drainage as a potentially safer alternative without increasing the need for repeat surgical intervention (Soleman et al., Journal of Neurosurgery, 2017; Oral et al., North Clinical Istanbul, 2015).

Drainage Strategy: Active vs Passive Drainage

Comparisons between active suction-based drainage and passive drainage systems did not demonstrate a consistent reduction in reoperation-requiring recurrence associated with active suction. Passive drainage systems achieved recurrence outcomes comparable to those of active systems when combined with adequate drain duration and closed drainage protocols.

Although active suction was employed to facilitate cavity collapse and accelerate fluid evacuation, its impact on reducing the need for repeat surgery remained inconclusive across included studies (Gazzeri et al., Journal of Neurosurgical Sciences, 2007; Oral et al., North Clinical Istanbul, 2015).

**Closed Drainage vs Underwater Drainage**

One large comparative cohort study directly evaluated underwater drainage systems versus conventional closed drainage systems following burr-hole evacuation. Underwater drainage was associated with a lower rate of reoperation-requiring recurrence, along with reduced postoperative pneumocephalus and improved radiological brain re-expansion (Ozdol et al., World Neurosurgery, 2024).

Despite these findings, the evidence supporting underwater drainage remains limited to a single-center retrospective cohort, and heterogeneity in drainage protocols precludes definitive conclusions regarding its superiority over conventional closed systems.

**Secondary Outcomes**

**Postoperative Infection**

Postoperative infection rates were low across all included studies and did not differ significantly according to drain position or drainage strategy. Subperiosteal and subgaleal drainage approaches demonstrated infection rates comparable to those of subdural drainage, with no consistent signal indicating increased infectious risk (Soleman et al., Journal of Neurosurgery, 2017; Oral et al., North Clinical Istanbul, 2015).

**Pneumocephalus**

Postoperative pneumocephalus was more frequently reported in studies utilizing conventional closed subdural drainage systems. Strategies designed to minimize air entry into the subdural space, particularly underwater drainage systems, were associated with lower pneumocephalus volumes and improved brain re-expansion (Nakaguchi et al., Journal of Neurosurgery, 2001; Ozdol et al., World Neurosurgery, 2024).

**Length of Hospital Stay**

Length of hospital stay varied across institutions and was influenced by local postoperative management protocols. Studies comparing underwater drainage systems with conventional closed drainage reported a modest reduction in hospital stay associated with underwater drainage, likely related to reduced pneumocephalus and lower reoperation rates (Ozdol et al., World Neurosurgery, 2024). In contrast, drain position alone (subdural versus subperiosteal or subgaleal) did not consistently affect hospitalization duration (Soleman et al., Journal of Neurosurgery, 2017; Oral et al., North Clinical Istanbul, 2015).

## Discussion

This systematic review provides a focused synthesis of contemporary evidence regarding drain type, drain position, and drainage strategy following burr-hole evacuation for chronic subdural hematoma, with particular emphasis on reoperation-requiring recurrence as a clinically meaningful endpoint. Using a predefined key words in PubMed/Medline, eight comparative studies were identified and analyzed qualitatively.

The review focused on recurrence necessitating reoperation, rather than radiological recurrence alone. While postoperative imaging frequently reveals residual or recurrent subdural collections, such findings do not uniformly translate into clinical deterioration or the need for further intervention. Previous studies and reviews have highlighted the heterogeneity and limited clinical relevance of radiological recurrence definitions (Ducruet et al., Journal of Neurosurgery, 2012; Ivamoto et al., Neurosurgical Review, 2016). By prioritizing reoperation as the primary outcome, the present review aligns more closely with patient-centered outcomes and real-world surgical decision-making.

Drain Position: Subdural versus Extracranial Approaches

Across the included studies, extracranial drain placement (subperiosteal or subgaleal) was not associated with higher rates of reoperation-requiring recurrence compared with traditional subdural drainage. These findings corroborate previous reports suggesting that avoidance of direct subdural catheterization does not compromise recurrence outcomes while potentially reducing drain-related intracranial complications (Soleman et al., Journal of Neurosurgery, 2017; Oral et al., North Clinical Istanbul, 2015).

From a mechanistic perspective, effective postoperative drainage appears to depend more on maintenance of a closed system and gradual cavity collapse than on the exact anatomical position of the drain tip (Nakaguchi et al., Journal of Neurosurgery, 2001; Santarius et al., Lancet, 2009). The comparable recurrence rates observed across different drain positions support the concept that extracranial drainage represents a safe and effective alternative to subdural drainage, particularly in patients at higher risk for drain-related intracranial complications (Soleman et al., Journal of Neurosurgery, 2017; Oral et al., North Clinical Istanbul, 2015).

Active versus Passive Drainage Strategies

The comparative evidence regarding active suction-based drainage versus passive drainage systems remains limited and inconclusive. Within the analyzed studies, active drainage did not consistently reduce the rate of reoperation-requiring recurrence compared with passive systems when adequate drain duration and closed drainage protocols were employed (Gazzeri et al., Journal of Neurosurgical Sciences, 2007; Oral et al., North Clinical Istanbul, 2015).

These findings suggest that routine application of active suction may not be necessary in all patients and that passive drainage may achieve equivalent outcomes while potentially minimizing the risk of excessive brain shift or negative pressure–related complications. However, heterogeneity in suction pressures and postoperative protocols limits definitive conclusions.

Closed versus Underwater Drainage Systems

Among the drainage strategies evaluated, underwater drainage represents a distinct technical modification designed to minimize postoperative air entry into the subdural space. The included comparative cohort study demonstrated a lower rate of reoperation-requiring recurrence, reduced pneumocephalus, and improved brain re-expansion associated with underwater drainage compared with conventional closed systems (Ozdol et al., World Neurosurgery, 2024).

These findings support the pathophysiological link between residual subdural air, impaired brain re-expansion, and recurrence, previously described in experimental and clinical studies (Nakaguchi et al., Journal of Neurosurgery, 2001). Nevertheless, given that evidence for underwater drainage is currently limited to single-center retrospective data, broader adoption should be approached cautiously until further multicenter or randomized data become available.

Secondary Outcomes and Clinical Implications

Secondary outcomes across included studies were generally consistent with primary findings. Postoperative infection rates were low and did not differ significantly according to drain position or drainage strategy. Pneumocephalus was more frequently observed in conventional closed drainage systems and appeared to correlate with recurrence risk, reinforcing the importance of air-minimizing techniques (Nakaguchi et al., Journal of Neurosurgery, 2001; Ozdol et al., World Neurosurgery, 2024).

Length of hospital stay was influenced primarily by postoperative complications and recurrence rather than by drain position alone. Studies comparing underwater and conventional closed drainage reported a modest reduction in hospitalization duration associated with underwater drainage, whereas drain position itself did not consistently affect length of stay (Soleman et al., Journal of Neurosurgery, 2017; Oral et al., North Clinical Istanbul, 2015; Ozdol et al., World Neurosurgery, 2024).

Limitations

This review has several limitations. First, despite a systematic search strategy, the number of included studies was limited, reflecting the scarcity of comparative data focused specifically on drainage strategy and reoperation-requiring recurrence. Second, significant clinical heterogeneity existed among studies with respect to drain duration, suction protocols, irrigation techniques, and follow-up intervals, precluding quantitative meta-analysis. Third, most included studies were retrospective, introducing potential selection bias and confounding related to surgeon preference and institutional practice patterns.

Future Directions

Future research should prioritize prospective, multicenter studies employing standardized definitions of recurrence and clearly reporting reoperation as a primary outcome. Direct comparisons between closed and underwater drainage systems, as well as standardized protocols for drain duration and removal criteria, would further clarify optimal postoperative management strategies in chronic subdural hematoma.

Conclusions

In patients undergoing burr-hole evacuation for chronic subdural hematoma, drain position alone does not appear to influence reoperation-requiring recurrence, provided effective postoperative drainage is achieved. Passive drainage systems yield outcomes comparable to active suction in most settings. Emerging evidence suggests that underwater drainage systems may reduce recurrence, pneumocephalus, and hospital stay; however, further high-quality studies are required before widespread adoption can be recommended.

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**Conflict of Interest Statement**

The authors declare that they have no conflict of interest related to this study.

**ICMJE COI Statement:**

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Table 1. Characteristics of the included studies

| Study | Year | Country | Study design | Sample size (n) | Surgical technique | Drain position | Drainage strategy |
|---|---|---|---|---|---|---|---|
| Gazzeri et al. | 2007 | Italy | Retrospective cohort | ~100 | Burr-hole evacuation | Subdural | Passive vs active |
| Oral et al. | 2015 | Türkiye | Retrospective comparative | 92 | Burr-hole evacuation | Subdural vs subgaleal | Passive |
| Soleman et al. | 2017 | Switzerland | Randomized controlled trial | 120 | Burr-hole evacuation | Subdural vs subperiosteal | Passive |
| Nakaguchi et al. | 2001 | Japan | Retrospective cohort | 80 | Burr-hole evacuation | Subdural | Closed passive |
| Santarius et al. | 2009 | UK | Randomized controlled trial | 215 | Burr-hole evacuation | Subdural | Closed passive |
| Pranata et al. | 2020 | Multi-national | Systematic review† | — | — | — | — |
| Ozdol et al. | 2024 | Türkiye | Retrospective comparative | 300 | Burr-hole evacuation | Subdural | Closed vs underwater |
| Moghib et al. | 2025 | Multi-national | Systematic review/meta-analysis† | — | — | — | — |

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