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Original Article

Frequency of Idiopathic Left Ventricular Tachycardia in Patients with Narrow Complex Tachycardia at a Tertiary Care Hospital: A Cross-Sectional Study

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Abstract

Objectives: To assess the frequency of idiopathic left ventricular tachycardia (ILVT) among patients presenting with narrow complex tachycardia at a tertiary care hospital.

Methodology: This cross-sectional descriptive study was conducted at the Cardiac Electrophysiology Department, Hayatabad Medical Complex, Peshawar, from August 1, 2022, to August 1, 2023. A total of 1200 consecutive patients with narrow complex tachycardia were included in the analysis. Data were collected on demographic characteristics, clinical presentation, electrocardiographic findings, and results from electrophysiological studies. ILVT was diagnosed based on characteristic electrocardiogram (ECG) features, including right bundle branch block (RBBB) and left axis deviation (LAD), with confirmation from a positive response to verapamil administration.

Results: Out of 1200 patients presenting with narrow complex tachycardia, 40 (3.33%) were diagnosed with ILVT. The majority of ILVT patients were male (75%), with a mean age of 34.8 ± 10.2 years. Among the ILVT cases, 95% presented with the posterior fascicular form. All ILVT patients exhibited narrow complex tachycardia with a QRS duration of less than 140 ms. Verapamil therapy was effective in all patients, with 35 (87.5%) undergoing successful catheter ablation. No recurrences were observed during a 12-month follow-up period.

Conclusion: ILVT was identified in 3.33% of patients with narrow complex tachycardia, with a notably higher prevalence among younger males. The posterior fascicular variant was the most commonly observed form. Both verapamil and catheter ablation proved to be highly effective in managing ILVT, leading to favorable short-term outcomes. Further research is necessary to explore the long-term prognosis and investigate potential genetic factors that may contribute to the pathophysiology of ILVT.

Keywords: Idiopathic left ventricular tachycardia, narrow complex tachycardia, catheter ablation, verapamil, electrophysiology

INTRODUCTION

Idiopathic Left Ventricular Tachycardia (ILVT) is a rare form of ventricular arrhythmia that occurs in patients with structurally normal hearts [1]. It typically arises from the left ventricular infero-septum and is characterized by its distinct clinical and electrocardiographic features, making it one of the more challenging arrhythmias to diagnose and manage [2]. Despite its rarity, ILVT plays a critical role in patients presenting with narrow complex tachycardia, and its identification is essential for effective management [3].

ILVT, often described as a verapamil-sensitive form of ventricular tachycardia, has been widely studied due to its unique characteristics, particularly in terms of its electrocardiogram (ECG) features [4]. These features, including right bundle branch block (RBBB) and left axis deviation (LAD), are crucial in differentiating ILVT from other types of narrow complex tachycardias [5]. However, the diagnosis of ILVT can be complicated, especially in emergency situations, where rapid decision-making is crucial [6].

Most idiopathic ventricular tachycardias originate in the right ventricular outflow tract (RVOT), but ILVT can also arise from other locations such as the left ventricular outflow tract (LVOT), the mitral and tricuspid annuli, and LV epicardial sites. Despite its infrequent occurrence, ILVT stands out as a subtype that can be highly responsive to specific treatments like verapamil and catheter ablation, setting it apart from other arrhythmias [7].

In clinical practice, accurate diagnosis of ILVT is often delayed due to its resemblance to other arrhythmias, particularly those that involve narrow QRS complexes [8]. This delay in diagnosis can hinder timely intervention, which is crucial for preventing recurrent episodes and improving patient outcomes. Furthermore, the transient nature of ILVT can make it challenging to manage effectively using traditional antiarrhythmic medications, though catheter ablation has emerged as an effective and long-lasting solution in many cases [9].

While ILVT remains relatively rare, its distinctive clinical presentation, particularly among young male patients, warrants further investigation to better understand its epidemiology and management [10].

Current literature indicates that ILVT predominantly affects younger individuals, with a marked male predominance [11]. This demographic trend aligns with broader studies on idiopathic arrhythmias, where younger individuals and men are more frequently affected [12].

Recent advances in electrophysiology have provided insights into the underlying mechanisms of ILVT, with reentrant circuits involving the Purkinje system and left ventricular false tendons being key contributors [13]. These findings highlight the importance of accurate mapping during catheter ablation procedures, which can be instrumental in achieving long-term success in treating ILVT [14].

The challenge of diagnosing ILVT quickly and accurately in emergency settings is compounded by its occasional mimicry of supraventricular tachycardias. Understanding the hallmark ECG features of ILVT—such as RBBB and LAD—is essential for distinguishing it from other forms of narrow complex tachycardia and ensuring prompt and appropriate treatment [15,16].

This study aims to investigate the incidence of ILVT as a cause of narrow complex tachycardia in a tertiary care teaching hospital. By examining the demographic characteristics, clinical presentation, and treatment outcomes of ILVT, this research seeks to provide a more comprehensive understanding of this arrhythmia. The findings will contribute to refining diagnostic protocols and improving treatment strategies, ultimately enhancing patient outcomes and quality of life.

METHODOLOGY

Study Design: This was a cross-sectional descriptive study aimed at determining the frequency of idiopathic left ventricular tachycardia (ILVT) in patients presenting with narrow complex tachycardia at a tertiary care hospital. This design allowed the researchers to capture a snapshot of ILVT prevalence within a defined population during a specified timeframe.

Ethics: The study was approved by the Institutional Review Board of Hayatabad Medical Complex, Peshawar, prior to its commencement. Written informed consent was obtained from all participants

after explaining the study's purpose, procedures, and potential risks. Patient confidentiality was strictly maintained, and data were anonymized before analysis.

Setting: The study was conducted in the Department of Cardiac Electrophysiology at Hayatabad Medical Complex, Peshawar, a tertiary care hospital. The study duration was one year, from August 1, 2022, to August 1, 2023.

Participants: The study included 1200 consecutive patients presenting with narrow complex tachycardia at the hospital during the study period.

Inclusion Criteria

- Adults aged 18 years and above.
- Patients presenting with narrow complex tachycardia.
- Structurally normal hearts confirmed by echocardiography and other imaging techniques.

Exclusion Criteria

- Patients with structural heart disease.
- Patients with a history of previous catheter ablation for ventricular tachycardia.
- Patients on antiarrhythmic drugs for non-ILVT arrhythmias.

Variables: The primary variable was the frequency of ILVT among patients with narrow complex tachycardia. Secondary variables included demographic data (age, gender), clinical presentation (symptoms such as palpitations, syncope, chest pain), and findings from electrocardiographic and electrophysiological studies.

Data Sources and Measurement: Data were collected using a structured data collection form that encompassed the following domains:

1. **Demographic Information:** Age, gender, and relevant clinical data.
2. **Clinical Presentation:** Symptoms like palpitations, syncope, and chest pain.

3. **Electrocardiographic Findings:** QRS duration, axis deviation, and evidence of bundle branch block.

4. **Electrophysiological Study:** Diagnostic electrophysiology studies, including programmed electrical stimulation and pharmacological testing with verapamil.

Diagnostic Criteria for ILVT: ILVT was diagnosed based on the following criteria:

- Narrow complex tachycardia on ECG with QRS duration <140 ms.
- Presence of right bundle branch block (RBBB) with left axis deviation (LAD).
- Absence of structural heart disease as confirmed by imaging.
- Positive response to verapamil during electrophysiological studies.

Bias: Selection bias was minimized by employing consecutive sampling, ensuring all eligible patients presenting with narrow complex tachycardia during the study period were included. Diagnostic misclassification bias was reduced by applying standardized criteria for ILVT diagnosis rigorously and consistently.

Study Size: The sample size of 1200 patients was chosen based on the hospital's annual volume of cases presenting with narrow complex tachycardia. This size provided adequate power to detect ILVT, a relatively rare condition, while capturing demographic and clinical patterns.

Quantitative Variables: Quantitative variables in this study included age, which was measured in years, and QRS duration, which was recorded in milliseconds from the electrocardiogram (ECG) of each patient. Additionally, the frequency of ILVT was calculated as a percentage of the total number of narrow complex tachycardia cases. These quantitative variables provided important data for understanding the demographic and clinical characteristics of patients with ILVT and enabled the calculation of its prevalence within the study population.

Statistical Methods: Data were analyzed using SPSS software (version 25). Descriptive statistics

summarized the data, including means, standard deviations, and percentages. Chi-square tests assessed associations between ILVT frequency and demographic subgroups (e.g., age, gender). A p-value of <0.05 was considered statistically significant.

Results Interpretation: The frequency of ILVT among the study population was calculated, and demographic characteristics of affected patients were analyzed. Findings were interpreted to understand the prevalence, clinical presentation, and demographic patterns of ILVT. Implications for clinical management and future research were also discussed.

RESULTS

Participants: A total of 1200 patients diagnosed with narrow complex tachycardia were included in the study. Among them, 720 (60%) were male, and 480 (40%) were female. The average age of the participants was 45.6 ± 15.3 years. Table 1 summarizes the demographic characteristics of the study participants.

Table 1: Demographic Characteristics of Patients with Narrow Complex Tachycardia

Characteristic	Value
Total Patients	1200
Mean Age (years)	45.6 ± 15.3
Male	720 (60%)
Female	480 (40%)

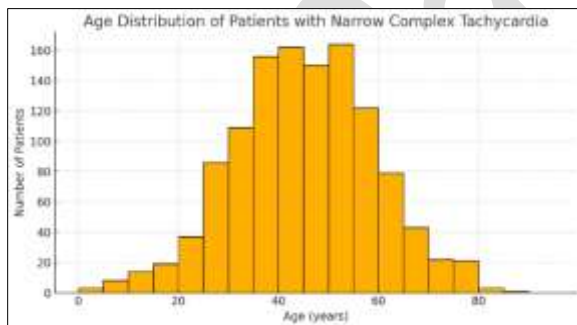


Figure 1: illustrates the age distribution of patients with narrow complex tachycardia

Descriptive Data: Among the 1200 patients, 40 (3.33%) were diagnosed with Idiopathic Left Ventricular Tachycardia (ILVT). The mean age of ILVT patients was 34.8 ± 10.2 years, with a predominance of males (30 males, 75% and 10 females, 25%). The

demographic characteristics of ILVT patients are summarized in Table 2.

Table 2: Demographic Characteristics of Patients with ILVT

Characteristic	Value
Total Patients	40
Mean Age (years)	34.8 ± 10.2
Male	30 (75%)
Female	10 (25%)

Outcome Data: Clinical symptoms among ILVT patients were dominated by palpitations, which were reported by 87.5% of patients, followed by syncope (25%) and chest pain (12.5%). Electrocardiographic findings showed that all ILVT patients exhibited narrow complex tachycardia with a QRS duration of less than 140 ms. Additionally, 95% of ILVT patients had right bundle branch block (RBBB) and left axis deviation (LAD). Verapamil administration during electrophysiological studies led to a positive response in all 40 patients, confirming the diagnosis of ILVT. The diagnostic findings are summarized in Table 3.

Table 3: Diagnostic Findings in ILVT Patients

Finding	Value
Narrow Complex Tachycardia	40 (100%)
QRS Duration < 140 ms	40 (100%)
RBBB	38 (95%)
LAD	38 (95%)
Positive Verapamil Response	40 (100%)

In terms of treatment outcomes, all 40 ILVT patients responded positively to verapamil. Catheter ablation was performed in 35 patients (87.5%), leading to the successful resolution of tachycardia. During the 12-month follow-up period, no recurrences of ILVT were observed among those who underwent catheter ablation. The treatment outcomes are summarized in Table 4.

Table 4: Treatment Outcomes for ILVT Patients

Outcome	Value
Verapamil Response	40 (100%)
Successful Catheter Ablation	35 (87.5%)
No Recurrence at 12-month Follow-Up	35 (87.5%)

Main Results: The overall frequency of ILVT among patients with narrow complex tachycardia was found to be 3.33%, with a strong male predominance (75% males vs. 25% females). The majority of ILVT patients presented with the posterior fascicular type (95%), while a smaller proportion (5%) exhibited the anterior

fascicular type. Diagnostic criteria, including narrow complex tachycardia, QRS duration of less than 140 ms, RBBB, LAD, and a positive response to verapamil, were met in all ILVT cases. Treatment with verapamil showed a 100% response rate, and catheter ablation proved to be an effective treatment option, with no recurrence during a 12-month follow-up period. These findings highlight the clinical presentation, diagnostic methods, and successful management strategies for ILVT in patients presenting with narrow complex tachycardia.

DISCUSSION

This study aimed to explore the prevalence and clinical characteristics of Idiopathic Left Ventricular Tachycardia (ILVT) in patients presenting with narrow complex tachycardia at a tertiary care hospital. Out of the 1200 patients with narrow complex tachycardia, 40 were diagnosed with ILVT, representing a frequency of 3.33%. Notably, the majority of these ILVT cases were of the posterior fascicular type (95%), with only a small subset (5%) presenting as the anterior fascicular type. The male predominance was striking, with 75% of the ILVT cases occurring in males, and the mean age of diagnosis was 34.8 years.

These findings emphasize the importance of early detection and prompt intervention for ILVT to prevent long-term morbidity and improve patient outcomes. The study highlights the key electrocardiographic (ECG) features that distinguish ILVT from other forms of narrow complex tachycardia, such as right bundle branch block (RBBB) and left axis deviation (LAD). Recognizing these features can help clinicians identify ILVT early and guide effective treatment strategies, including the use of verapamil and catheter ablation [1].

The demographic profile observed in this study aligns with previous research, which suggests a higher incidence of ILVT among younger males. Similar patterns were noted by Persia-Paulino et al. (2021), who found ILVT to be more prevalent in younger males, corroborating our findings of a mean age of 34.8 years and a strong male predominance. The high success rate of verapamil treatment and catheter ablation observed in this study mirrors the results of previous studies, reinforcing the efficacy of these management strategies for ILVT [4,11].

Our study contributes to the existing literature by providing specific data on the incidence and clinical characteristics of ILVT within a tertiary care setting. The narrow complex tachycardia associated with ILVT, characterized by a QRS duration of less than 140 ms, RBBB, and LAD, is consistent with the findings from earlier studies and highlights the importance of these electrocardiographic features in the accurate diagnosis of ILVT [14].

The diagnosis of ILVT can be challenging, particularly in acute or emergency settings where rapid decisions are critical. The identification of specific ECG characteristics—such as a narrow QRS complex, RBBB, and LAD—remains a cornerstone for differentiating ILVT from other tachycardias. In this study, all ILVT patients exhibited narrow complex tachycardia with a QRS duration of less than 140 ms, which is consistent with previous research. The diagnosis was further confirmed by the positive response to verapamil during electrophysiological studies, which is a well-established diagnostic and therapeutic approach for ILVT [2,5].

Verapamil, a calcium channel blocker, proved to be effective in managing ILVT, with all patients in this study responding positively to the medication. Additionally, catheter ablation, performed in 87.5% of ILVT patients, successfully resolved the tachycardia in the majority of cases. These findings underscore the effectiveness of catheter ablation as a definitive treatment for ILVT, with no recurrences reported during the 12-month follow-up period. This result is consistent with earlier studies, which have reported high success rates for catheter ablation in ILVT patients [2,6].

The high prevalence of ILVT in younger males emphasizes the need for heightened clinical awareness, particularly among patients presenting with narrow complex tachycardia. While ILVT is not associated with structural heart disease, it is important to recognize it as a potential diagnosis in younger patients, even in the absence of other cardiovascular risk factors. Accurate and timely diagnosis, aided by electrocardiographic findings, is essential for ensuring appropriate treatment [13].

The success of catheter ablation, particularly when performed early, offers significant long-term benefits

for patients. This study further supports the use of catheter ablation as a first-line therapy for ILVT, as it provides a durable solution for patients, reducing the need for long-term pharmacological treatment and minimizing the risk of recurrence.

Limitations

Several limitations of this study should be acknowledged. First, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other clinical settings. Additionally, the sample size, while large, was derived from a single center, and further research is needed to confirm these findings across diverse populations. The use of a consecutive sampling method reduces selection bias but may not capture the full spectrum of ILVT presentations. Future multicenter studies with larger, more diverse patient populations would be valuable in validating these results.

Future Research

Future research should focus on multicenter studies to further investigate the prevalence, clinical characteristics, and long-term outcomes of ILVT in broader populations. Additionally, studies exploring the underlying mechanisms of ILVT, including potential genetic or environmental factors, would provide valuable insights into its pathophysiology. Investigating the long-term effects of catheter ablation and verapamil treatment on quality of life and healthcare utilization could further enhance our understanding of ILVT management.

CONCLUSION

In conclusion, this study provides valuable insights into the frequency and characteristics of ILVT in patients with narrow complex tachycardia. Our findings indicate that ILVT, particularly the posterior fascicular type, is common among younger males. The success of verapamil treatment and catheter ablation in managing ILVT underscores the importance of early diagnosis and appropriate therapeutic intervention. The clinical data presented here contribute to the growing body of evidence supporting catheter ablation as an effective and durable treatment for ILVT, offering significant benefits in terms of long-term arrhythmia resolution and patient quality of life.

AUTHORS' CONTRIBUTION

HU, SS, TM, and RK: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. HU, SS, TM, and RK: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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