Idiopathic Fascicular Left Ventricular Tachycardia: A Case Report

Kadek Agus Putra Udayana, I Putu Parwata Jaya
Department of Cardiology, Wangaya Distric Hospital, Denpasar, Bali, Indonesia

ABSTRACT

Idiopathic fascicular left ventricular tachycardia (IFLVT) is the most common idiopathic ventricular tachycardia (IVT) of the left ventricle. ILFVT is characterized by right bundle branch block and left axis deviation. We report a case of IFLVT in a 34-year-old woman presenting with palpitation. The ECG revealed a wide QRS complex tachycardia with a right bundle branch block (RBBB) and right axis deviation. Vagal maneuvers were ineffective. Conversion to sinus rhythm was obtained 10 hours later, with i.v amiodarone. The patient was discharged after 3 days on oral verapamil.

Keywords: Idiopathic ventricular tachycardia, right bundle branch block complex tachycardia, verapamil

ABSTRAK

Idiopathic Fascicular Left Ventricular Tachycardia (IFLVT) adalah bentuk paling sering *Idiopathic Ventricular Tachycardia* (IVT) ventrikel kiri. ILFVT ditandai dengan blok cabang berkas kanan dan penyimpangan sumbu ke kiri. Kami melaporkan kasus IFLVT pada wanita 34 tahun yang mengalami palpitasi. EKG menunjukkan takikardi kompleks QRS lebar dengan morfologi blok cabang berkas kanan dan penyimpangan sumbu ke kanan. Manuver vagal tidak efektif. Konversi ke irama sinus diperoleh 10 jam kemudian dengan amiodaron i.v.. Pasien dipulangkan setelah 3 hari dengan verapamil oral. **Kadek Agus Putra Udayana, I Putu Parwata Jaya. *Idiopathic Fascicular Left Ventricular Tachycardia*: Laporan Kasus**

Kata kunci: Blok cabang berkas kanan, *idiopathic ventricular tachycardia*, verapamil

INTRODUCTION

Broad complex tachycardia presents a diagnostic and therapeutic challenge to the emergency physician. The majority of cases are ventricular tachycardia (VT) with underlying ischaemic heart disease.[1] Broad complex tachycardia may also occur as a result of a supraventricular tachycardia (SVT) in the presence of aberrant conduction. Differentiation has important implications for management and prognosis. If VT is mistakenly diagnosed as SVT with aberrant conduction and treated with calcium channel blockers, the patient is likely to become haemodynamically unstable.[2] Some clinicians therefore advocate assumption that all cases of broad complex tachycardia are VT.[1,2]

Idiopathic ventricular tachycardia (IVT) is a term used for VT in the absence of clinically apparent structural heart disease and accounts for approximately 10% of all VTs.[3] Idiopathic fascicular left ventricular tachycardia (IFLVT) is the most common IVT of the left ventricle and represents the 10-15% of all IVT.[4] Zipes, *et al*, first described IFLVT in 1979.[5] They reported three VT cases with right bundle branch block (RBBB) and left axis after atrial pacing. Two years later, Belhassen, *et al*,[6] described that intravenous verapamil significantly decreased the recurrence rate of IFLVT.

It may be difficult to differentiate IFLVT from SVT because both are characterized by the absence of structural heart disease and the same ECG based on QRS morphology or RS interval. Vagal maneuvers, adenosine, and lidocaine are ineffective in IFLVT; it is terminated or suppressed by calcium antagonists.[7]

CASE

A 34-year-old woman was admitted to the emergency department referred from private hospital with sudden onset of palpitations. She complained palpitations since about 3 hours. The palpitations was not accompanied with shortness of breath, chest pain nor syncopal attack. She is breastfeeding an 8-month child. She also complained of fever since a day ago. She is non-smoker and has no known history of any medical illness or drug use; with no similar previous complaint.

Physical examination in previous hospital, revealed blood pressure was 110/80 mmHg, pulse rate 222 beats/minute, and body temperature 38,5 ºC. On cardiac examination, S1 and S2 were normal, no murmurs nor additional sounds. The chest was clear on auscultation. On electrocardiogram (ECG), lead I rhythm showed a broad complex tachycardia with QRS duration 120 ms. Lead II and III rhythms showed an apparent narrow QRS complex tachycardia with QRS duration 80 ms. Lead V1 showed monophasic R pattern and R/S in V6 less than 1. A 12-lead ECG revealed wide QRS complex tachycardia with a right bundle branch block (RBBB), and right

Presented at Bali Cardiology Update VII 2018

Alamat Korespondensi *email: putraudayana91@gmail.com*


axis deviation (**Figure 1**). Vagal manouver were tried but failed to terminate the arrhythmia. Cardiology consultation was sought and a diagnosis of fascicular tachycardia was suspected. Intravenous amiodarone was administered with a dose of 150 mg in the first 10 minutes and continued with a maintenance dose of 900 mg in 24 hours. It was successfully converted to sinus tachycardia 3 hours later (**Figure 2**). Then the patient was referred to a public hospital because of the unavailability of intensive care.

In the referral hospital, the hemodynamic was stabile, blood pressure 100/70 mmHg, pulse rate 110 beats/minute, respiratory rate 20/ minute, and body temperature 38,5ºC. Only intravenous amiodarone was given with a maintenance dose of 900 mg in 24 hours.

After 10 hours, ECG shows sinus rhythm. The patient was admitted to the intensive cardiology care unit where serial ECGs were done. Laboratory tests only revealed leukocytosis with neutrophils increase. Acute mastitis was diagnosed based on examination. The symptoms was relieved after antibiotics was given. Echocardiography showed a nondilated left ventricle with normal systolic and diastolic function. Amiodarone were still administered intravenously until it run out within 24 hours. The patient was discharged after 3 days on oral verapamil 80 mg three times a day and advised for electrophysiological study or catheter ablation.

DISCUSSION

ILFVT generally presents in young adults aged 15-40 year-old, mainly affects males (60%-80%).[8] Symptoms typically include dizziness, palpitations, chest discomfort, and occasionally syncope. Although most episodes occur at rest, exercise, infection, emotional stress and catecholamine infusion can act as triggers. Triggered activity was at first postulated as a potential mechanism,[5] but later studies showed that IFLVT behaves electrophysiologically as a reentrant tachycardia.[8]

The baseline ECG is normal in most patients; it may present T-wave inversion immediately after tachycardia (cardiac memory). Unlike patients with structural heart disease, IFLVT usually shows a QRS complex duration inferior to 140-150 ms and fast initial forces (RS interval of 60-80 ms).[9] Both features can lead to misdiagnosis of aberrant supraventricular tachycardia. Capture beats and fusion beats may be present, suggesting the diagnosis of VT rather than SVT . Physical findings that indicate the presence of AV dissociation strongly suggests VT.[2,10] Valsalva maneuver, carotid sinus massage or adenosine administration may also facilitate the elucidation of tachycardia mechanism. Termination of tachycardia using these procedures strongly suggests SVT.[10] VT due to triggered mechanism such as idiopathic outflow tract VT may be terminated as well with these maneuvers.[10,11] Even if the arrhythmia remains unaffected, these maneuvers may clarify the mechanism of tachycardia by exposing AV dissociation in the case of VT.[10]

The traditional ECG criteria favouring VT includes AV dissociation, capture or fusion beats, negative or positive concordance, and tachycardia QRS narrower than sinus QRS.[10,11] The traditional criteria needs determination that the broad complex has a right bundle branch block (RBBB)-like or a left bundle branch block (LBBB)-like pattern. In RBBB-like pattern, criteria suggesting VT: (i) QRS width >140 ms, (ii) left axis deviation, and (iii) in lead V1 found QR, or R, or RSr' with lead V6, R/S <1 or QS. Whereas, in LBBB-like pattern, criteria suggesting VT: (i) QRS width >160 ms, (ii) right axis deviation, and (iii) initial R in V1 >30 ms, or slurring /notching of the downstroke of the S wave in V1-2, or begin QRS-nadir S-wave >70 ms in V1-2, with Q in V6.[11]

In 1991, Brugada, *et al*, produced simple criteria in a stepwise approach irrespective of the QRS complex morphology.[10,11] The

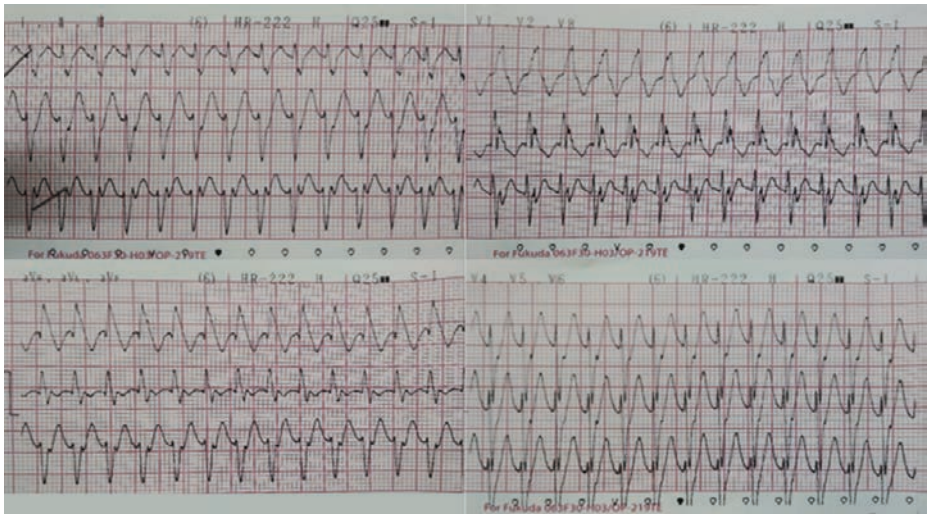

Figure 1. ECG during ventricular tachycardia. ECG shows a monomorphic right bundle branch block tachycardia with a relative narrow QRS duration (narrower than other forms of VT), and right axis deviation

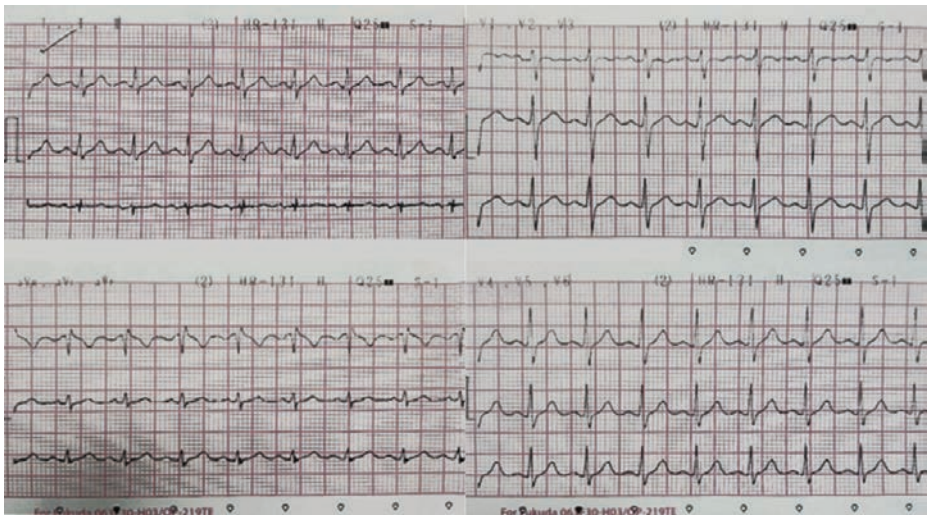

Figure 2. ECG after 2 hour of amiodarone infusion. ECG shows conversion to sinus tachycardia

algorithm begins with the identification of an RS complex in any precordial lead, if negative, the diagnosis of VT is made. If an RS complex is present in one or more precordial leads, the next step is to measure the longest RS interval. If an RS interval is longer than 100 ms, the diagnosis of VT is made. If not, the next step of the algorithm is to consider whether AV dissociation is present. If positive, the diagnosis of VT is made. If absent, the classical morphology criteria for VT are used. If both lead V1 and V6 fulfil the criteria for VT, the diagnosis of VT is made. If not, the diagnosis of SVT with aberrant conduction is made by exclusion of VT.[11]

In 2007, a new algorithm has been proposed by Vereckei, *et al*.[10,11] The following criteria were suggestive of VT: (i) AV dissociation; (ii) an initial R-wave in lead aVR, and (iii) the voltage during the initial 40 ms (Vi), the terminal 40 ms (Vt), their ratio (Vi /Vt), and that Vi /Vt ≤1 was suggestive of VT. In 2008, the same group presented a simplified algorithm using only lead aVR. Using this algorithm, VT can be diagnosed if one of these conditions found in lead aVR; (i) an initial R-wave, (ii) width of an initial r- or q-wave >40 ms, (iii) notching on the initial downstroke of a predominantly negative QRS complex, and (4) Vi /Vt ≤ 1.[11]

ILFVT might be difficult to diagnose using these morphological criteria, as most studies did not include these patients.[11] In 2017, a new criteria to differentiate the QRS morphology of Posterior Fascicular Ventricular Tachycardia from Right Bundle Branch Block and Left Anterior Hemiblock Aberrancy has been reported by Michowitz et al. They found criteria were suggestive of VT: (i) atypical V1 morphology, (ii) QRS width ≤ 140 ms, (iii) R/S ratio in V6 ≤ 1, and (iv) positive aVR.[12]

The electrocardiographical pattern varies depending on the site of origin of the tachycardia. Posterior fascicular VT by far accounts for the majority of IFLVT, representing over 90% cases. The surface electrocardiogram demonstrates tachycardia with a RBBB pattern and a left superior axis deviation. Other forms of IFLVT include anterior fascicular VT presenting with a RBBB and right axis deviation as well as the more rare upper septal fascicular VT which can present with either a RBBB, left bundle branch block (LBBB), or a normal QRS.[6]

As in other idiopathic ventricular tachycardia, IFLVT diagnosis requires exclusion of structural heart disease. It is therefore recommended to perform echocardiography and coronary angiography or computed tomography, if deemed necessary depending on the cardiovascular risk profile of the patient.[13] Diagnosis and the mechanism IFLVT can be clarified using the electrophysiological study.[3,4,13]

As in other cases of wide QRS tachycardia, the hemodynamic status should evaluated. Electrical cardioversion is emergent in case of tachycardia intolerance. In stable patients, as its name suggests, first line treatment is verapamil.[6] Intravenous amiodarone was successful as the second line of acute management in 4 children with IFLVT; the VT slowed down and was finally terminated in 3 patients (within 1-48 hours)[14] However, unlike other idiopathic VT, IFLVT usually does not respond to vagal maneuvers, adenosine, or beta blockers.[15] This has been attributed to the fact that IFLVT depends on the slow entry of calcium in partially depolarized Purkinje fibers and not the cyclic adenosine monophosphate mediated triggered activity occurring in the adenosine-sensitive VT.[15]

Verapamil may be helpful in patients with mild symptoms.[9,13] If symptoms are severe and pharmacologic treatment is not effective or is poorly tolerated, catheter ablation is recommended.[9] Ablation success rates as reported in various series vary between 85 and 95%, generally higher in posterior IFLVT. Recurrence rates are also lower in these patients (5% vs. 12.5%).[16,17]

CONCLUSION

A diagnosis of fascicular tachycardia should be considered if standard methods including vagal maneuvers and adenosine administration fail to convert the arrhythmia and the 12-lead ECG shows a right bundle branch block with left axis deviation. Diagnosis can be clarified by electrophysiological study. In the acute setting, first-line pharmacological treatment is verapamil. Catheter ablation is effective and is recommended when symptoms are severe or when pharmacological treatment is ineffective and poorly tolerated or not preferred by the patient.

REFERENCES

1. Akhtar M, Shenasa M, Jazayeri M, Caceres J, Tchou PJ. Wide QRS complex tachycardia: Reappraisal of a common clinical problem. Ann Intern Med. 1988;109:905–12.
2. Stewart RB, Bardy GH, Greene HL. Wide complex tachycardia: Misdiagnosis and outcome after emergent therapy. Ann Intern Med. 1986;104:766–71.
3. Aliot EM, Stevenson WG, Almendral-Garrote JM, Bogun F, Calkins CH, Delacretaz E, et al. European Heart Rhythm Association/ Heart Rhythm Society expert consensus on catheter ablation of ventricular arrhythmias. Europace. 2009;11:771-817.
4. Lerman BB, Stein KM, Markowitz SM. Mechanisms of idiopathic left ventricular tachycardia. J Cardiovasc Electrophysiol. 1997;8:571-83.
5. Zipes D, Douglas PR, Troup PJ, Pedersen DHl. Atrial induction of ventricular tachycardia: Reentry versus triggered automaticity. Am J Cardiol. 1979;44:1-8.
6. Belhassen B, Rotmensch HH, Laniado S. Response of recurrent sustained ventricular tachycardia to verapamil. Br Heart J. 1981;46:679-82.
7. Lin FC, Finley CD, Rahimtoola SH, Wu D. Idiopathic paroxysmal ventricular tachycardia with a QRS pattern of right bundle branch block and left axis deviation: A unique clinical entity with specific properties. Am J Cardiol. 1983;52:95-100.
8. Nakagawa M, Takahashi N, Nobe S, Ichinose M, Ooie T, Yufu F, et al. Gender differences in various types of idiopathic ventricular tachycardia. J Cardiovasc. Electrophysiol. 2002;13:633-8.
9. Andrade FR, Eslami M, Elias J, Kinoshita O, Nakazato Y, Marcus FI, et al. Diagnostic clues from the surface ECG to identify idiopathic (fascicular) ventricular tachycardia: Correlation with electrophysiologic findings. J Cardiovasc Electrophysiol. 1996;7:2-8.
10. Vereckei A. Current Algorithms for the diagnosis of wide QRS complex tachycardias. Curr Cardiol Rev. 2014;10:262-76.
11. Alzand BSN, Crijns HJGM. Diagnostic criteria of board QRS complex tachycardia: Decades of evolution. Europace. 2011;13:465-72.
12. Michowitz Y, Tovio Brodie O, Heusler I, Sabbag A, Rahkovich M, Shmueli H, et al. Differentiating the QRS morphology of posterior fascicular ventricular tachycardia from right bundle branch block and left anterior hemiblock aberrancy. Circ Arrhythm Electrophysiol. 2017;10(9):e005074.


13. Reviriego SM. Idiopathic fascicular left ventricular tachycardia. e-Journal ESC Council for Cardiology Practice. 2010;9:13-20.
14. Suesaowalak M, Khongphatthanayothin A, Sunsaneewitayakul B, Sirisopikun T, Promphan W, Jariyapongpaiboon Y, et al. Idiopathic left ventricular tachycardia in children. J Med Assoc Thai. 2008;91(11):1732-8.
15. Lerman BB. Response of nonreentrant catecholamine mediated ventricular tachycardia to endogenous adenosine and acetylcholine. Evidence for myocardial receptor mediated effects. Circulation. 1993;87:382-90.
16. Peichl P, Wichterle D, Pavlu L, Cihak R, Aldhoon B, Kautzner J. Complications of catheter ablation of ventricular tachycardia: A single center experience. Circ Arrhythm Electrophysiol. 2014;7:684-90.
17. Lamberti F, Di Clemente F, Remoli R, Bellini C, De Santis A, Mercurio M, et al. Catheter ablation of idiopathic ventricular tachycardia without the use of fluoroscopy. Int J Cardiol. 2015;190:338-43.