Increasing Trend in Ventricular Tachycardia Related Mortality- Cause or Effect?

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Abstract

Ventricular tachycardia is a major cause of sudden death. Several pharmacological and device-based therapies in recent years have delayed the progression of heart failure and have improved survival. A new study reveals a significant increase in age-adjusted mortality from ventricular tachycardia over the past 13 years, with higher mortality in men, black Americans and patients from the Southern United States. These findings reinforce the previous observations made on the influence of age, gender, ethnicity and geography on cardiovascular outcomes. The use of ICD 10 codes to ascertain cause of death limits differentiation between ventricular tachycardia as the true underlying mechanism leading to death and the presence of ventricular tachycardia in patients dying from other causes. While the insights gained from the report on contemporary ventricular tachycardia related mortality in the general population with cardiovascular disease is hypothesis generating, further studies are needed to delineate ventricular tachycardia as a proximate cause of death from an association.

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Sudden cardiac death claims up to 350,000 lives every year in the United States, and overall survival rates post arrest remain dismal [1]. Ventricular arrhythmias are a leading cause of sudden cardiac death accounting for 24% of out of hospital cardiac arrests and portend a more favorable recovery compared to non-shockable rhythms[2]. Although ischemic heart disease remains the leading cause of ventricular arrhythmias, other forms of nonischemic cardiomyopathy associated with myocardial fibrosis and hypertrophy are gaining prominence. Although patients with severe LV dysfunction are at the highest risk for ventricular

arrhythmias[3], tomographic imaging has aided in in identification of higher risk patients with occult structural heart disease despite preserved LVEF [4]. Contemporary patients with heart disease today benefit from a range of pharmacological and device-based therapies that delay the progression of heart failure. It is reasonable to speculate that as these patients survive longer that they may develop arrhythmic complications. Thus, it is imperative that we periodically reassess the relative contribution of arrhythmic versus non-arrhythmic death in patients with heart disease.

In this issue of the Journal, Lee and colleagues contribute a research letter that adds provocative new information regarding temporal mortality trends associated with ventricular tachycardia. The authors queried a CDC database to assess VT-associated mortality trends in patients with underlying heart disease between 2007 and 2020. Patients with VT listed as the proximate cause of death (ICD-10 code I47.2) who had underlying cardiovascular diagnoses (ICD-10 codes I00-I78) were included in the analysis. Age-adjusted mortality rates for ventricular tachycardia and average annual percentage change were reported.

The study reports a significant increase in age-adjusted mortality ascribed to ventricular tachycardia over the past 13 years. Adjusted mortality was higher with increasing age, in men versus women, in black compared to white Americans, and in the Southern versus non-Southern regions of the United States. The authors attribute the increase in mortality rate from ventricular tachycardia to the higher prevalence of structural and ischemic heart disease in an increasingly aging population. The authors also speculate an increase in the diagnosis of ventricular tachycardia due to the increase in the use of invasive and non-invasive cardiac rhythm monitoring devices over that period. Gender-related differences in modality from ventricular tachycardia are attributed to the higher prevalence of ischemic cardiomyopathy in men. The higher mortality in the black Americans is attributed to their higher prevalence of associated cardiovascular risk factors, as well as socioeconomic factors that affect access to care.

The authors findings support and expand previous observations regarding the influences of age, gender, ethnicity, and geography on cardiovascular outcomes. Prospective cohort studies have shown that the incidence of ventricular arrhythmias increases with age [0.5 vs 0.3 per 1000 population in age group >65 years compared to <65 years] and are more prevalent in men [0.59% in men compared to 0.2% in women over 65] [5]. In patients with nonischemic cardiomyopathy, the prevalence of late gadolinium enhancement is also higher in men compared to women [4, 6]. These factors may explain the gender differences in mortality related to ventricular tachycardia. Ethnic disparities in heart failure outcomes have been documented in multiple studies including CARDIA and MESA, with worse heart failure outcomes in black populations across age groups. The authors are commended for examining outcome disparities related to patient groups that are traditionally underrepresented in clinical trials.

The study suggests that mortality trends from ventricular tachycardia have worsened despite advances in medical therapy and widespread use of implantable cardioverter defibrillators. The use of ICD-10 diagnosis of VT to inform the mechanism of death is an obvious limitation of the authors' report. The specific diagnosis of monomorphic ventricular tachycardia is assumed; however, the specific rhythm diagnosis was not possible in these patients raising the possibility that other forms of ventricular arrhythmias (e.g. polymorphic VT or ventricular fibrillation) were also present. Furthermore, although VT may be seen at the time of death, it is often triggered by other severe cardiovascular or medical illnesses that are the true mortality drivers. It is well-known that ventricular tachycardia is often seen in patients with acute coronary syndrome, structural heart disease, heart failure, metabolic abnormalities, infiltrative disorders of the heart etc., all of which could potentially be responsible for mortality in these patients. The study methodology is unable to differentiate mortality resulting from ventricular tachycardia and ventricular tachycardia being present in patients dying from other etiologies. Thus, the authors' observations should not be interpreted as increasing "lethality" of VT in these patients. The use of a broad range of ICD-10 codes to document associated "cardiovascular disease" in the study cohort also raises the possibility of multiple unmeasured confounding variables that may have independently affected patient survival.

The prevalence of arrhythmias in patients infected with COVID-19 has been well-documented. Studies have reported ventricular arrhythmias in up to 5.9% of patients infected with COVID-19, particularly patients

with evidence of myocardial injury and myocarditis[7]. Patients with cardiovascular comorbidities also have more severe disease course from COVID infection. It is interesting to speculate whether the spike in age-adjusted mortality in 2019-2020 may have been affected by COVID-related illness.

The authors' report offers hypothesis generating insights into VT-related mortality in the contemporary era. Further studies are needed to provide mechanistic insight into the observed association of VT and death as either proximate cause or association. Dedicated studies in underrepresented ethnic groups may allow identification of novel clinical or biochemical risk factors that can modulate disease course. Clearly there is more work to be done.

References:

1. Al-Khatib, S.M., et al., *2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society.* J Am Coll Cardiol, 2018.**72** (14): p. e91-e220.

2. McNally B, R.R., Mehta M, Vellano K, Valderrama AL, Yoon PW, Sasson C, Crouch A, Perez AB, Merritt R, Kellermann A; Centers for Disease Control and Prevention. Out-of-hospital cardiac arrest surveillance — Cardiac Arrest Registry to Enhance Survival (CARES), United States, October 1, 2005–December 31, 2010. MMWR Surveill Summ. 2011 Jul 29;60(8):1-19. PMID: 21796098.

3. Tang, P.T., M. Shenasa, and N.G. Boyle, *Ventricular Arrhythmias and Sudden Cardiac Death.* Card Electrophysiol Clin, 2017.**9** (4): p. 693-708.

4. Di Marco, A., et al., *Late Gadolinium Enhancement and the Risk for Ventricular Arrhythmias or Sudden Death in Dilated Cardiomyopathy: Systematic Review and Meta-Analysis.* JACC Heart Fail, 2017.**5** (1): p. 28-38.

5. Khurshid, S., et al., *Frequency of Cardiac Rhythm Abnormalities in a Half Million Adults.* Circ Arrhythm Electrophysiol, 2018.**11** (7): p. e006273.

6. Di-Marco, A., et al., *Ventricular Arrhythmias and Sudden Death in Nonischemic Dilated Cardiomyopathy: Matter of Sex or Scar?* J Card Fail, 2022. **28** (8): p. 1278-1286.

7. Khan, M.H., et al., *Ventricular Tachycardia or Fibrillation Storm in Coronavirus Disease.* Case Rep Cardiol, 2022. **2022** : p. 1157728.