**Objective**

*Understand how the ventricular substrate is affected by psychological triggers, which are modulated by the autonomic nervous system, leading to ventricular tachycardia and ventricular fibrillation.*

**Road map**

1. Ventricular substrate
2. History
3. Story of sudden cardiac death
4. Autonomic modulation
5. Heart rate variability
6. Triggering sudden death
7. Autonomic risk

**Timeline**

1889 John MacWilliam proposed that VF was the mechanism behind SCD.1 Prior names were *fatal syncope, delirium cordis, circus contraction,* and *intervermiform*

1914 Garrey found that a fibrillating ventricle required a minimum mass, and <4 cm could not sustain VF.2

1916 The first cardiac sympathectomy was performed by ﻿Jonnesco to protect a patient from recurrent angina pectoris and ventricular tachyarrhythmias, and was successful.3

1947 The first defibrillation occurred in an operating room on a 14-year old boy undergoing repair of a pectus deformity by Dr. Claude Beck.4

1968 Coronary care units, advocated for by Dr. Bernard Lown, had existed now for several years, with a notable drop in SCD after MI, from >40% to <20%.5

1970 Chest thump was indicated for reverting ventricular tachycardia and preventing cardiac arrest, supported by studies in NEJM.6

1971 Case series of SCD after proximal stressful event (grief, loss, mourning, threat), but also happy events like a reunion (such as with *happy heart syndrome*).7

1973 In an industrial plant in Rochester, NY, there were 26 reported cases of sudden death. Interviews with family noted that these individuals had been depressed over the past several weeks, and the events happened in the setting of acute arousal, either through increased work, anxiety, or anger.8 In Finland, study on 229 cases of SCD were identified to have preceding life stressors. 9

1975 Circulation published work by Kolman and Lown on vagal stimulation as having a protective effect on susceptibility to VF.10

1981 Parasympathetic blockade was found to extinguished high frequency changes in heart rate variability, suggesting a vagal influence.11

1983 Metoprolol was found to be effective at reducing ventricular arrhythmias after myocardial infarction.12 The 1980s were part of the wide-spread adoption of beta-blockers in myocardial ischemia.

1990 Japanese reported severe negative stress precipitated a cardiomyopathy involving apical ballooning, now known as *Takotsubo syndrome*.13

1991 Schwartz demonstrated that accentuated anatagonisn of stmpathetic tone by vagal tone occurred in conscious canines for the first time.14

1999 Muller described the pattern of MACE to have a bimodal distribution during the day, from 6 AM to 10 AM, and then secondly at 6 PM to 8 PM.15

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