Incidence and Timing of Major Arrhythmias in T2D and CKD: A Real-World Analysis

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Introduction

- Type 2 diabetes (T2D) is a leading cause of chronic kidney disease (CKD).
- Despite strong links between T2D, CKD, and cardiovascular disease, the incidence and timing of major arrhythmias in this high-risk population remains unclear.
- This study examines the incidence, timing, and risk associations of major arrhythmias in T2D-CKD patients.

Methods

- We analyzed Symphony Integrated Dataverse (2018-2024) claims data on adults with CKD (Stage 1-4) following T2D, assessing arrhythmia occurrence, timing, and metabolic/cardiovascular risk factors.

Table 1: Demographics

Demographics	T2D → Arrhythmia → CKD (N=397,359)	T2D → CKD → Arrhythmia (N=272,644)
Age at T2D Index		
18-34	334 (0.1%)	202 (0.1%)
35-44	2,248 (1%)	1,319 (0.5%)
45-54	13,108 (3%)	7,705 (3%)
55-64	55,339 (14%)	31,892 (12%)
65+	326,330 (82%)	231,526 (85%)
Sex		
Male	221,293 (56%)	148,382 (54%)
Female	176,066 (44%)	124,262 (46%)

Results

- Among 3.2M T2D patients with CKD after T2D diagnosis (51% females, median age 73; 49% males, median age 72), 670,003 (21%) developed major arrhythmias, primarily atrial fibrillation (AF) **(Table 1,Table 2)**.
- In 59% of patients with CKD after T2D **(Figure 1)**, arrhythmias preceded CKD (56% males, median age 73; 44% females, median age 74). In those patients:
  - T2D-to-arrhythmia median time: 488 days (range: 1-2,362); arrhythmia-to-CKD median time: 462 days (1-2,368).
  - 33,640 (8%) had major adverse cardiovascular events (MACE) after CKD (55% males, median age 76; 45% females, median age 76). Arrhythmia-to-MACE median time: 800 days (2-2,348).
- In 41% of patients with CKD after T2D **(Figure 1),** arrhythmias followed CKD (54% males, median age 75; 46% females, median age 76). In those patients:
  - CKD-to-arrhythmia median time: 355 days (1-2,003).
  - 45,520 (17%) had MACE on or after arrhythmia (54% males, median age 76; 46% females, median age 76). Arrhythmia-to-MACE median time: 3 days (0-1,918), CKD-to-MACE median time: 461 days (1-1,998).

Figure 1: Patient Funnel

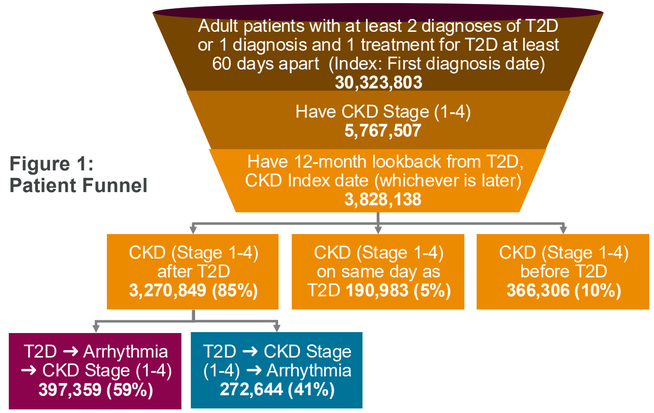

Table 2: Cardiovascular risk factors within 6 months before or after arrhythmia index date

	T2D → Arrhythmia → CKD (Stage 1-4) (N=397,359)				T2D → CKD (Stage 1-4) → Arrhythmia (N=272,644)			
Number of patients	**170,298**	**2,398**	**125,983**	**68,870**	**31,047**	**554**	**21,308**	**13,791**
Type of arrhythmia	**% patients with cardiovascular risk factors**	**Non-MACE CVD***	**Hypertension†**	**MACE‡**	**% patients with cardiovascular risk factors**	**Non-MACE CVD***	**Hypertension†**	**MACE‡**
Atrial Fibrillation	86%	86%	86%	88%	78%	80%	77%	79%
Atrial Flutter	19%	18%	18%	20%	11%	10%	11%	12%
AV Block first degree	12%	10%	12%	11%	13%	11%	14%	14%
AV Block other	3%	2%	3%	3%	2%	2%	2%	2%
AV Block second degree	4%	4%	4%	4%	4%	3%	4%	4%
AV Block third degree	7%	6%	7%	8%	6%	6%	6%	7%
Supraventricular Tachycardia	13%	15%	13%	12%	8%	13%	8%	8%
Ventricular Tachycardia	11%	13%	9%	14%	6%	6%	5%	8%

* Non-MACE Cardiovascular Disease (CVD) includes Cardiomyopathy, Myocarditis, and Thromboembolism. † Hypertension includes Essential (primary) hypertension, Secondary hypertension, Intraoperative and postprocedural complications and disorders of circulatory system not elsewhere classified, and Hypertensive crisis & Abnormal blood-pressure reading without diagnosis. ‡ MACE includes Stroke, Myocardial Infarction, Congestive Heart Failure and Acute Coronary Syndrome.

Conclusions

Arrhythmias are common in T2D-CKD and strongly linked to MACE. Identifying shared mechanisms between T2D, CKD, and arrhythmias requires innovative diagnostic approaches, including continuous ambulatory EKG monitoring to drive early intervention and precision therapies.

Abbreviations

M = million; AF = atrial fibrillation; AV = atrioventricular; CKD = chronic kidney disease; CVD = cardiovascular disease; EKG = electrocardiogram; MACE = major adverse cardiovascular events; T2D = Type 2 diabetes.

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