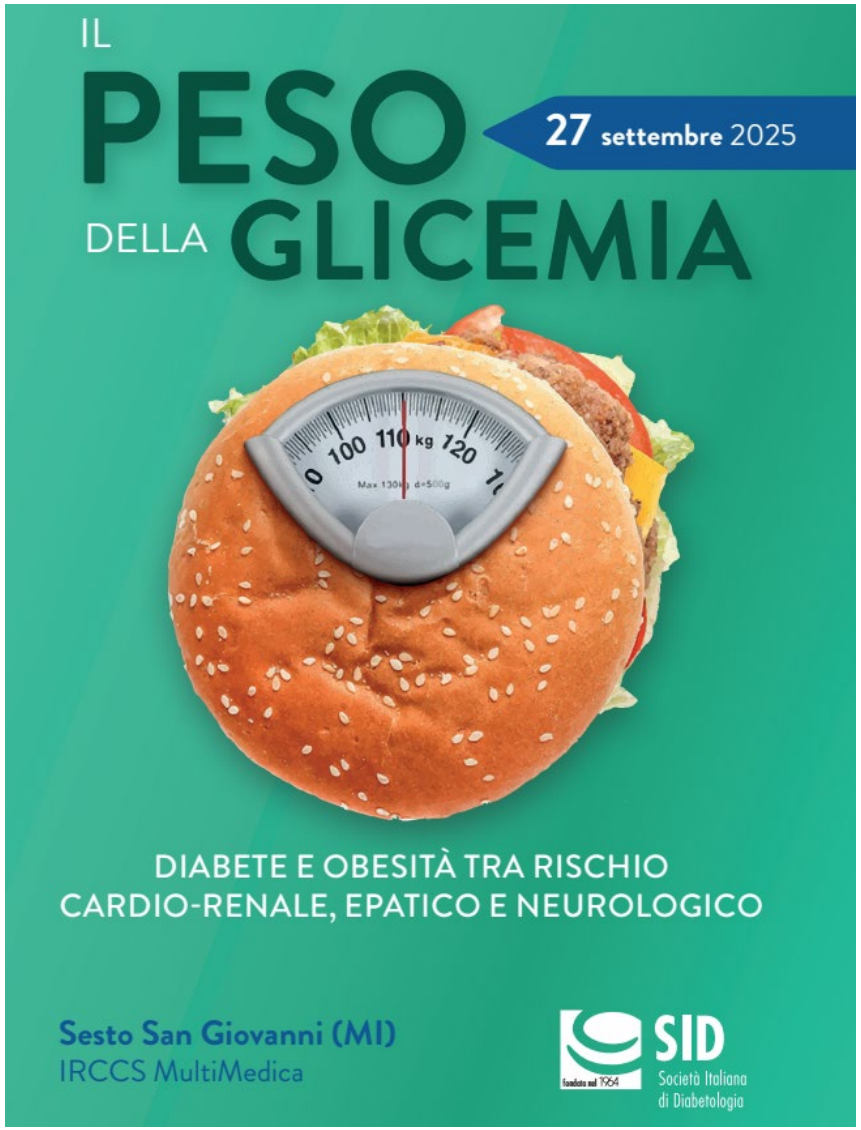


Malattia renale nel diabete: sempre nefropatia diabetica?

Carlo Guastoni
U.O. Nefrologia

Gruppo MultiMedica
Passione, ricerca e innovazione per la salute

Il sottoscritto Dr. Carlo Maria Guastoni dichiara di NON aver ricevuto negli ultimi due anni compensi o finanziamenti da Aziende Farmaceutiche e/o Diagnostiche

Dichiara altresì il proprio impegno ad astenersi, nell'ambito dell'evento, dal nominare, in qualsivoglia modo o forma, aziende farmaceutiche e/o denominazione commerciale e di non fare pubblicità di qualsiasi tipo relativamente a specifici prodotti di interesse sanitario (farmaci, strumenti, dispositivi medico-chirurgici, ecc.).

IDF Diabetes Atlas 2025

Diabetes is one of the leading causes of chronic kidney disease (CKD). Up to 40% of people living with diabetes develop CKD, and the number of new cases of CKD in people with type 2 diabetes increased by 74% between 1990 and 2017. The prevalence of diabetes-related CKD varies widely between countries. The majority of epidemiological data on CKD comes from high-income countries, but countries with lower socioeconomic status experience the largest increase in diabetes prevalence and their populations with diabetes are at higher risk of CKD.

This report looks at the relationship between diabetes and kidney disease across the globe and ways to reduce its impact.

40%

Up to 40% of people living with diabetes develop CKD

The Term of «Diabetic kidney Disease» is increasingly used to refer persistent albuminuria or a reduction in eGFR in the setting of diabetes and moves away from connotations of specific underlying renal pathology

Diabetologia (2023) 66:482–494
https://doi.org/10.1007/s00125-022-05826-y

Diabetologia 2023; 66:482

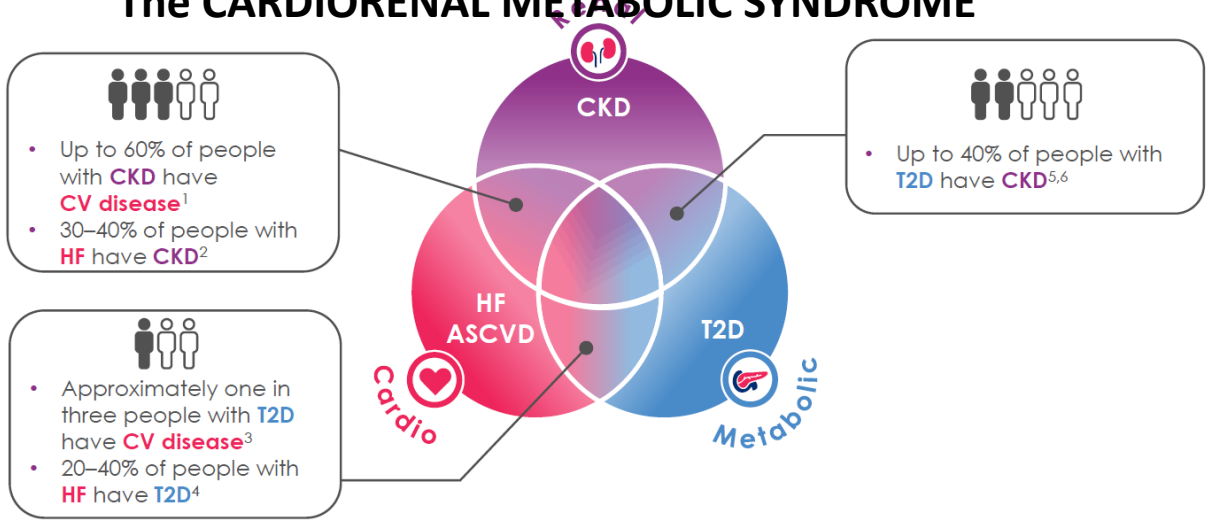
ARTICLE

Kidney function measures and cardiovascular outcomes in people with diabetes: the Hoorn Diabetes Care System cohort

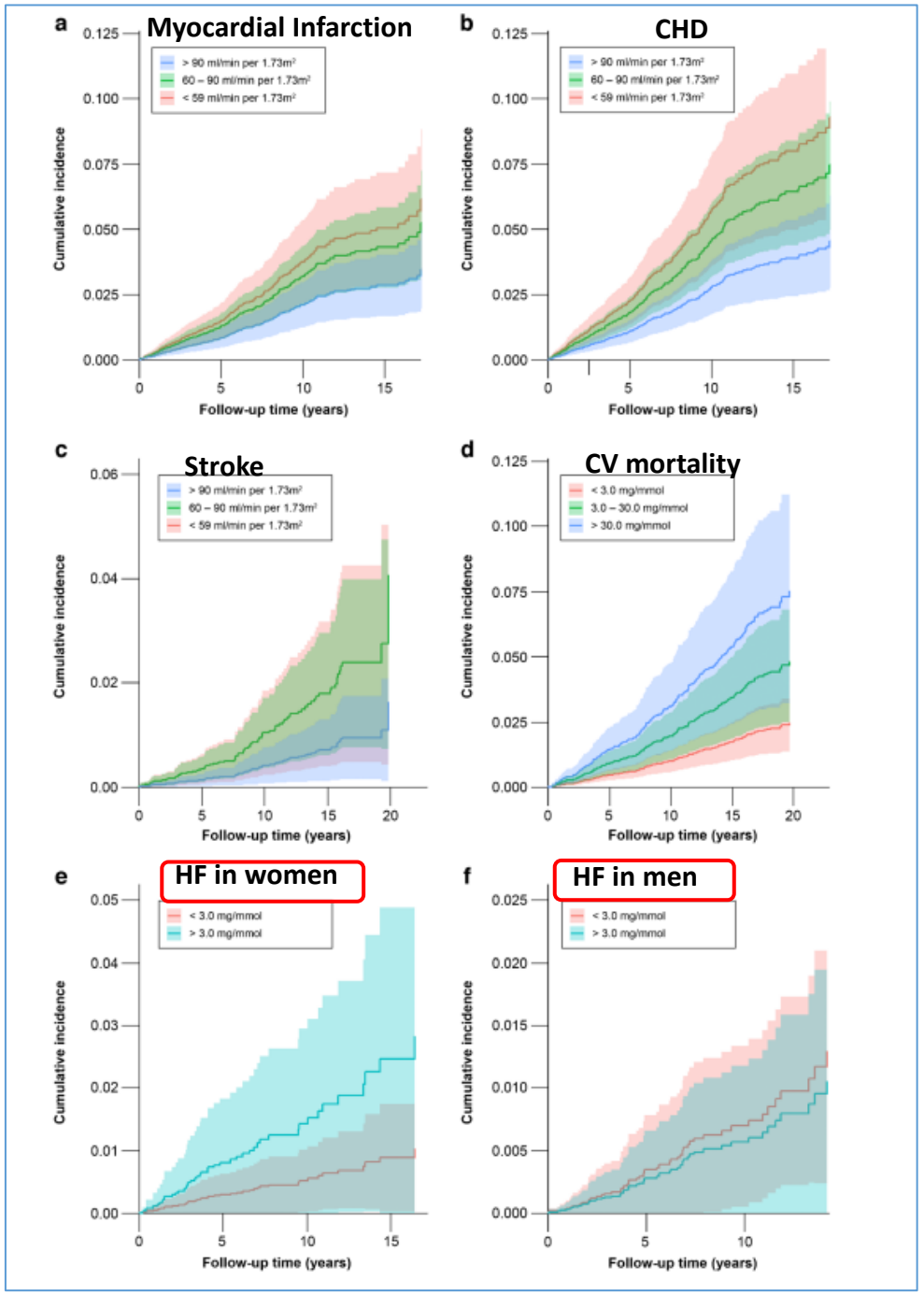
Elisa Dal Canto[1] · Petra J. M. Elders[2] · Amber A. van der Heijden[2] · Adriana J. van Ballegooijen[3] · Birgit I. Lissenberg-Witte[3] · Femke Rutters[3] · Joline W. J. Beulens[3,4]

Cardiovascular, renal and metabolic conditions frequently coexist because they are interrelated

The CARDIORENAL METABOLIC SYNDROME



ASCVD, atherosclerotic cardiovascular disease; CKD, chronic kidney disease; CV, cardiovascular; HF, heart failure; T2D, type 2 diabetes
1. Lovre D *et al. Endocrinol Metab Clin North Am* 2018;47:237; 2. Ahmed A *et al. Heart Fail Clin* 2008;4:387; 3. Einarson TR *et al. Cardiovasc Diabetol* 2018;17:83; 4. Thomas MC *et al. Curr Cardiol Rev* 2016;12:249; 5. Afkarian M *et al. JAMA* 2016;316:602; 6. International Diabetes Foundation. Diabetes Atlas 9th Edition. http://www.diabetesatlas.org (accessed Mar 2023)



Review Article

Classification and Differential Diagnosis of Diabetic Nephropathy

J Diab Res 2017

Chenyang Qi,[1] Xing Mao,[1] Zhigang Zhang,[1,2] and Huijuan Wu[1,2]

Table 1: Diabetic nephropathy is divided into four hierarchical glomerular lesions.

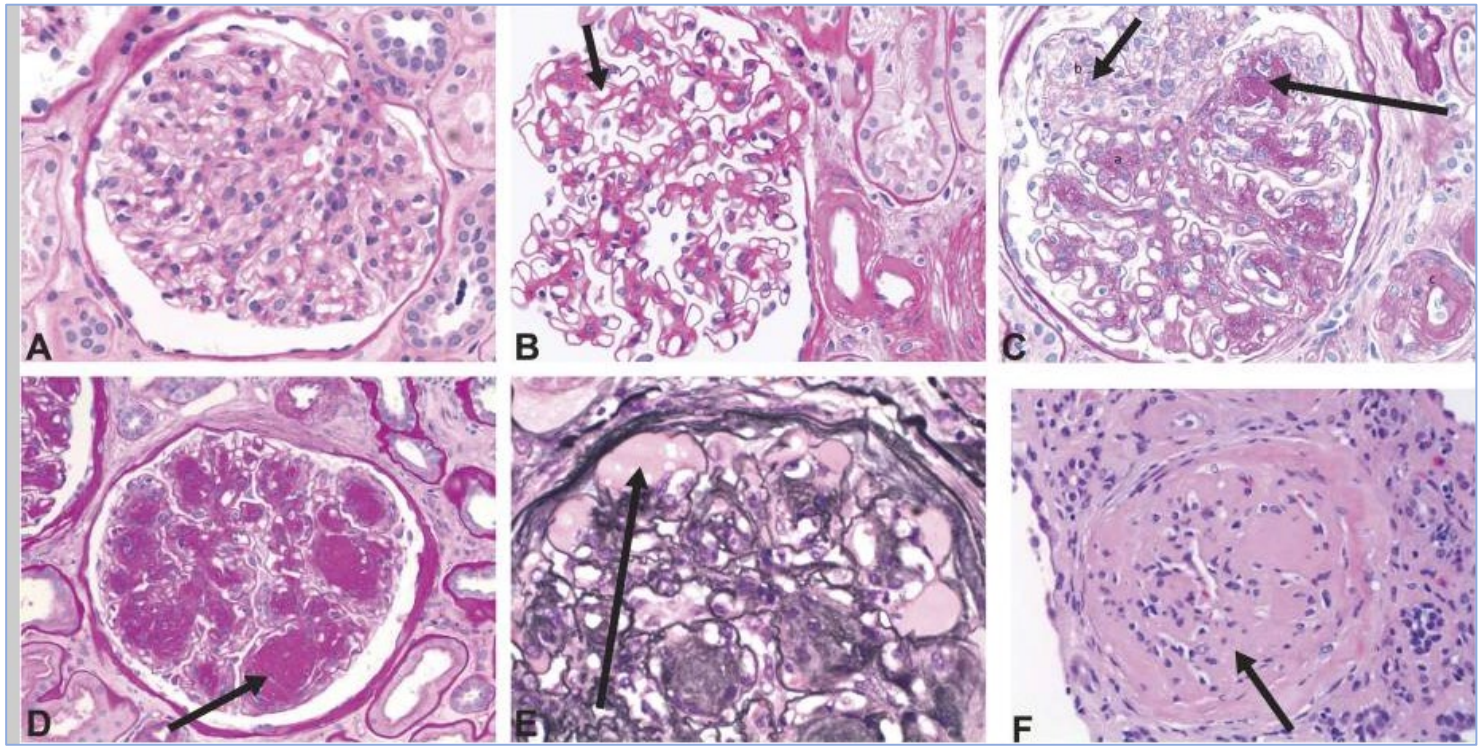
Class	Description and criteria
I	Mild or nonspecific changes on light microscopy and conformed GBM thickening proven by electron microscopy: GBM > 395 nm (female), GBM > 430 nm (male).
IIa	Mild mesangial expansion in >25% of the observed mesangium; area of mesangial proliferation < area of capillary cavity.
IIb	Severe mesangial expansion in >25% of the observed mesangium. Area of mesangial proliferation < area of capillary cavity.
III	At least one convincing nodular sclerosis (Kimmelstiel-Wilson lesion).
IV	Advanced diabetic glomerulosclerosis in >50% of glomeruli.

Table 2: Separate scoring system of interstitial and vascular lesions of DN.

Lesion	Criteria	Score
Tubulointerstitial lesions	No IFTA	0
	IFTA < 25%	1
	25% < IFTA < 50%	2
	IFTA > 50%	3
Interstitial inflammation	Absent	0
	Relate to IFTA	1
	In areas without IFTA	2
Arteriolar hyalinosis	Absent	0
	One hyaline arteriole	1
	More than one hyaline arteriole	2
Arteriosclerosis (most severely affected artery)	No intimal thickening is observed	0
	Intimal thickening is less than the thickness of the media	1
	Intimal thickening is more than the thickness of the media	2

Note. IFTA: tubulointerstitial fibrosis and tubular atrophy.

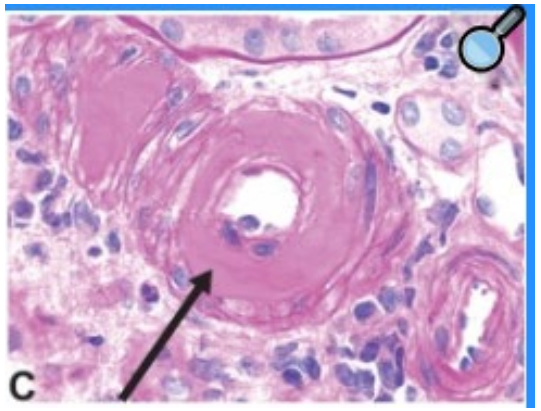
Terveart TWC et al JASN 2010; 21: 556

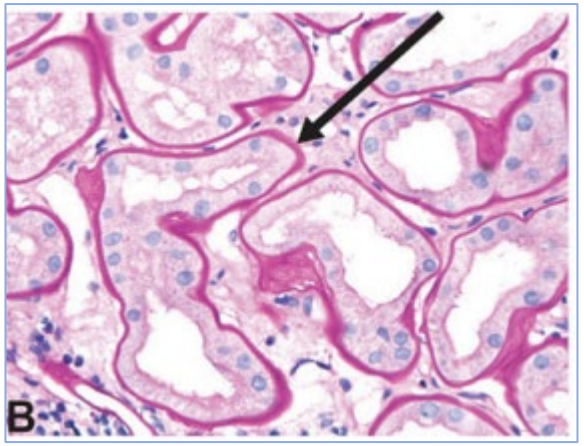


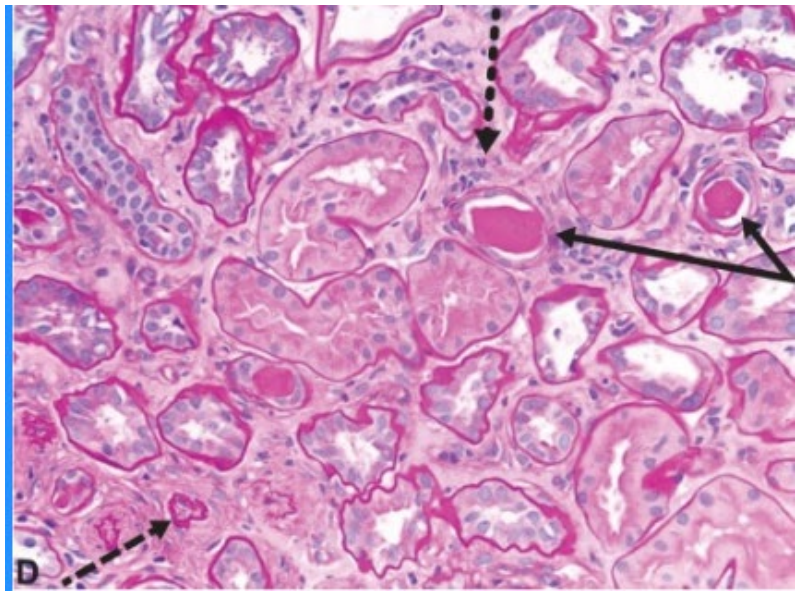
Diabetic Kidney Disease
Challenges, Progress, and Possibilities

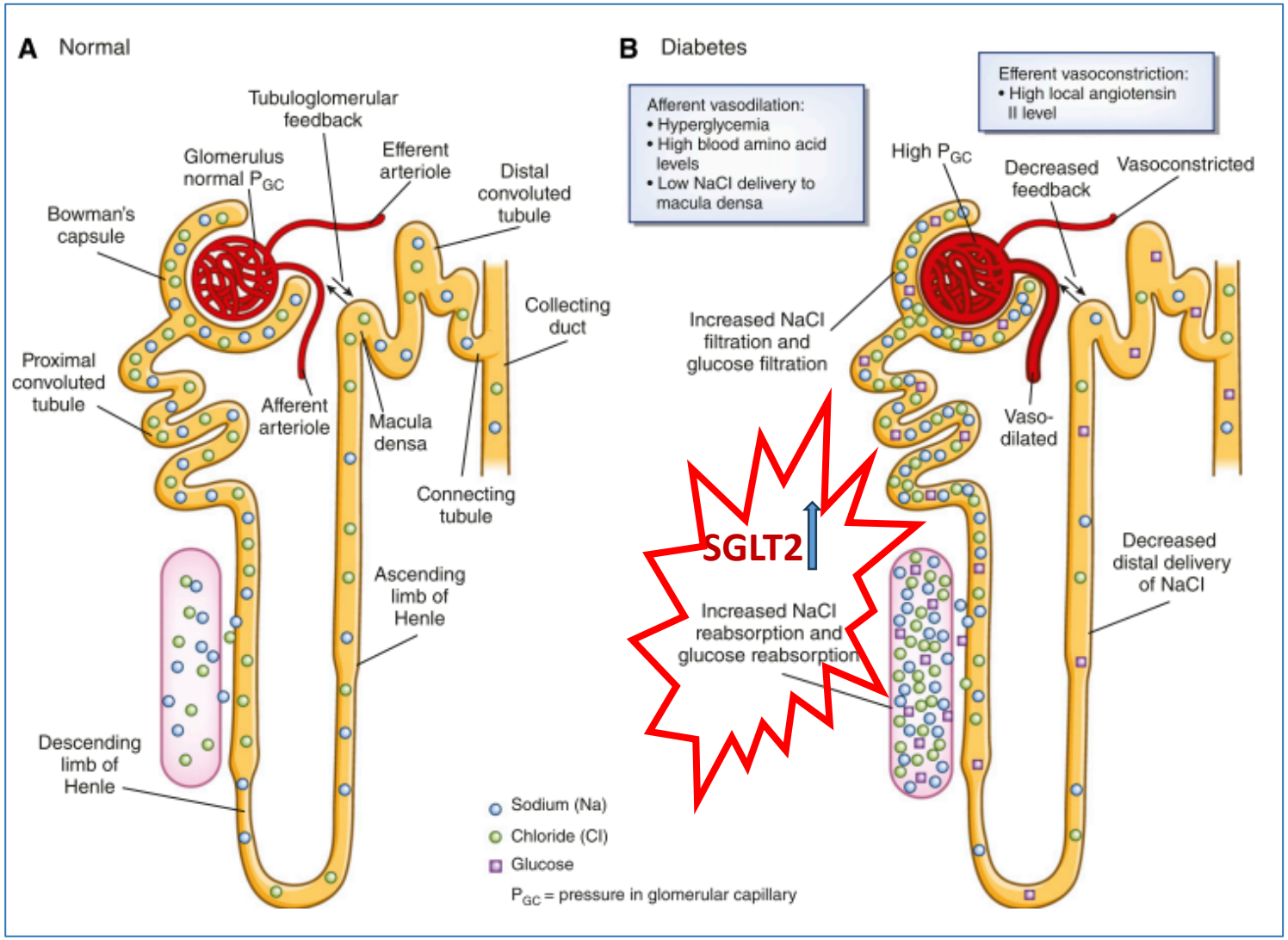
Radica Z. Alicic,† Michele T. Rooney,* and Katherine R. Tuttle*†‡§‖*

CJASN 2017; 18:2032



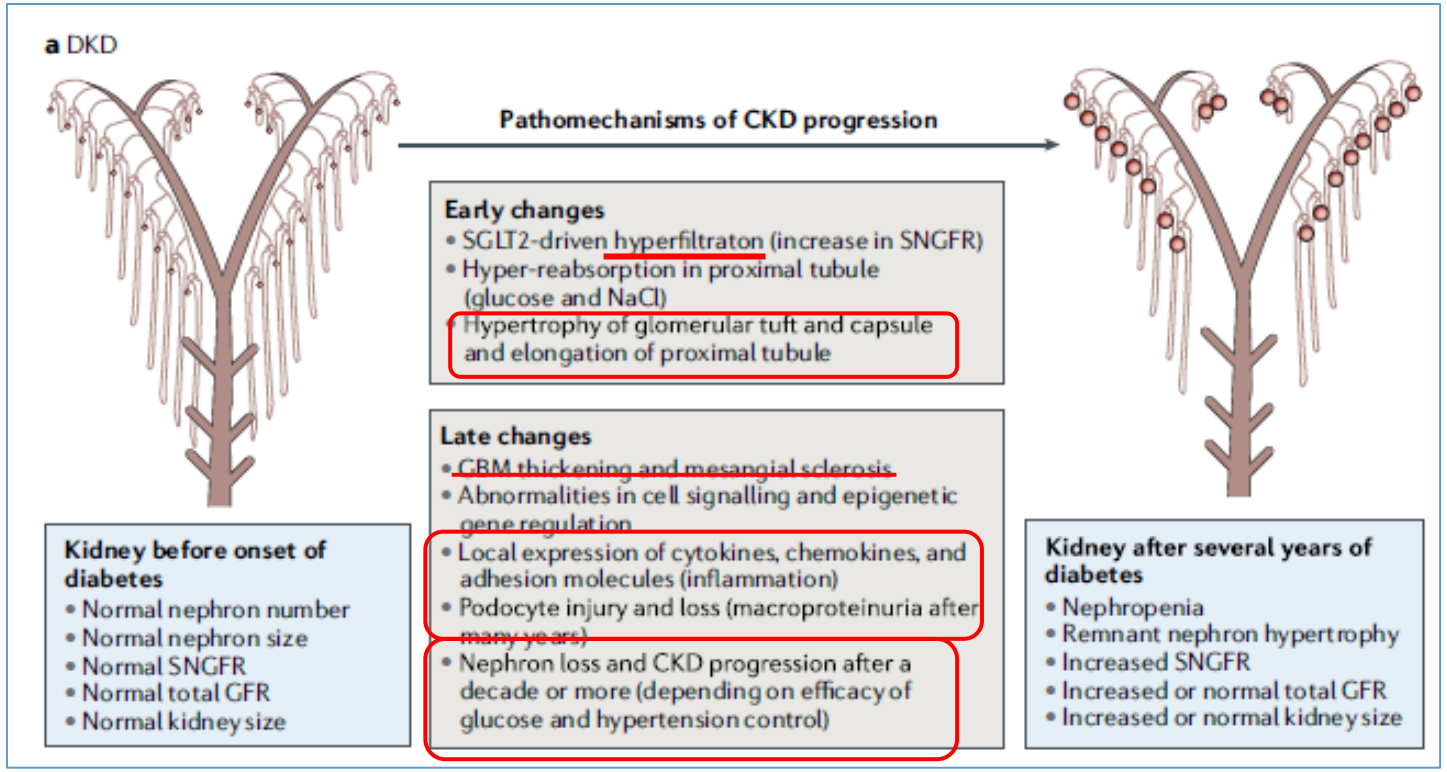




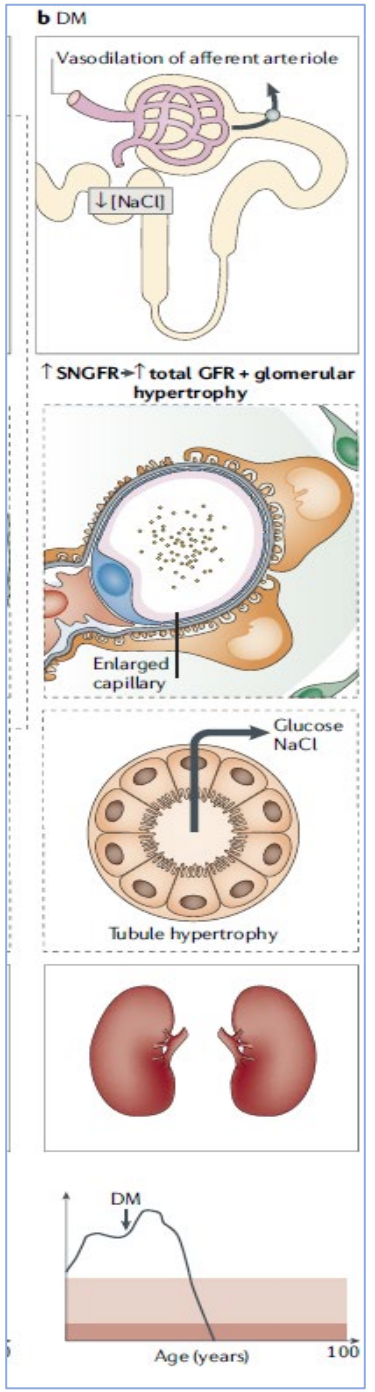


Alicic RZ CJASN 2017; 12: 2032

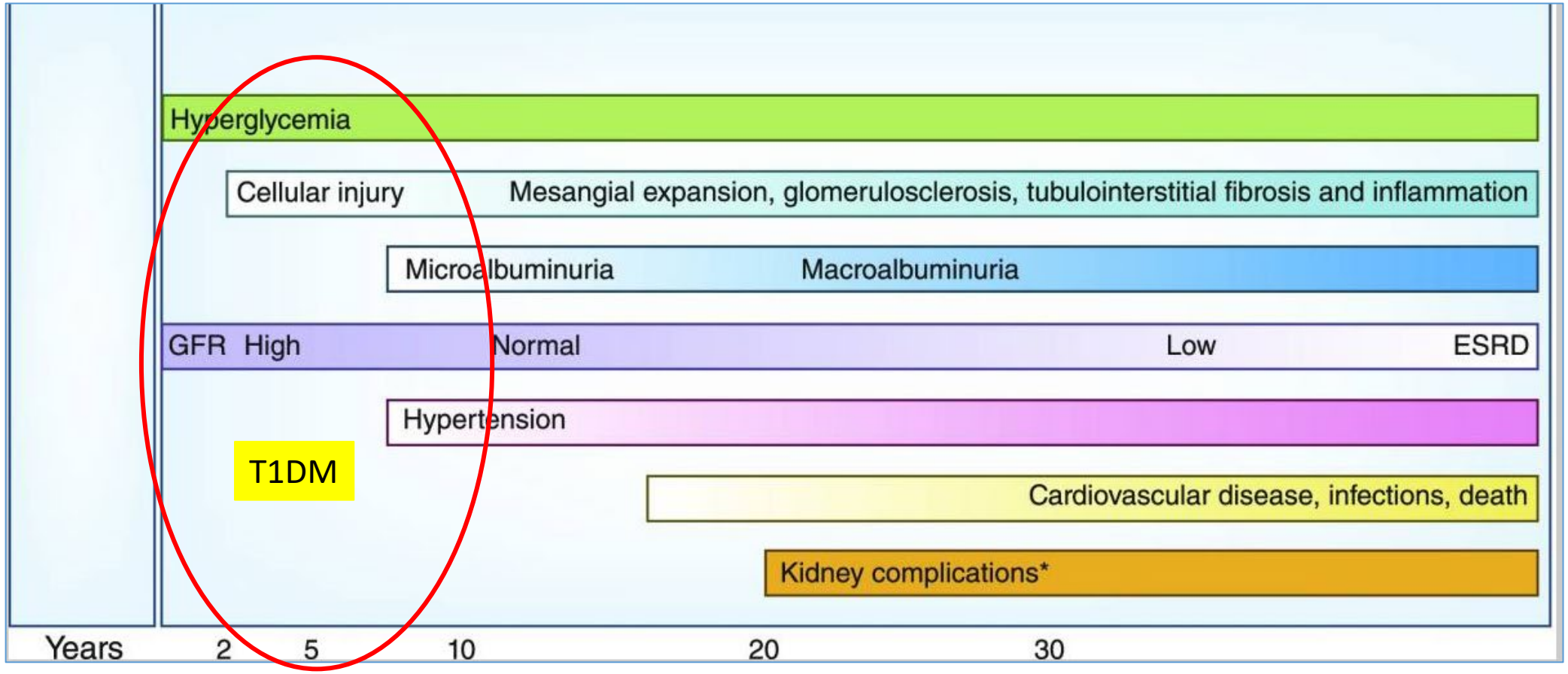
DIABETIC KIDNEY DISEASE



Anders HJ et al Nature Rev Nephrol 2018; 14:361



The natural history of Diabetic Nephropathy



Kussman MJ et al JAMA 1976; 335:1636

ORIGINAL ARTICLE

WILEY

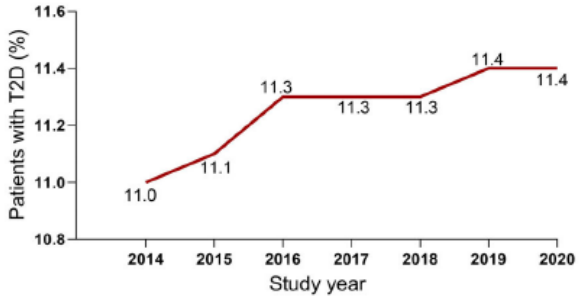
Prevalence of obesity and cardiovascular disease in adults with type 2 diabetes and use of diabetes medication in Germany: A claims data study

Nora Hennies PhD[1] | Sven W. Görgens PhD[1] | Jonas Killer MSc[1] | Thorsten Otto MSc[1] | Lena M. Richter MSc[2] | Dirk Müller-Wieland MD[3] | Dennis Häckl PhD[2,4]

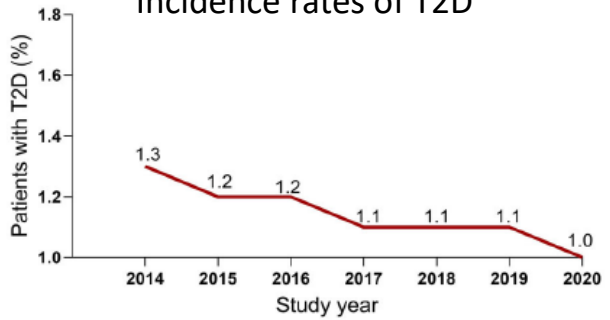
Diabetes Obes Metab 2024; 26: 5636

(A)

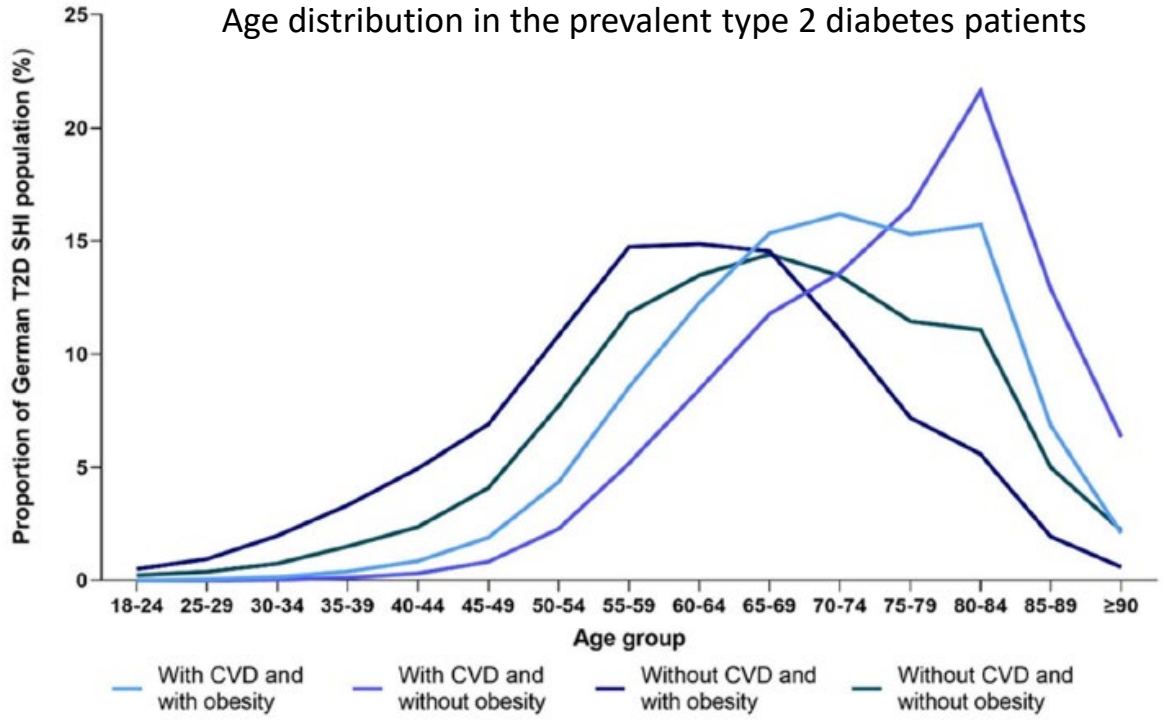
Prevalence rates of T2D



Incidence rates of T2D



Age distribution in the prevalent type 2 diabetes patients



International Journal of Molecular Sciences

Int J mol Sci 2025; 26:6247

MDPI

Review

Obesity-Related Glomerulosclerosis—How Adiposity Damages the Kidneys

Justyna Zbrzeźniak-Suszczewicz [1], Agata Winiarska [1], Agnieszka Perkowska-Ptasińska [2] and Tomasz Stompór [1,*]

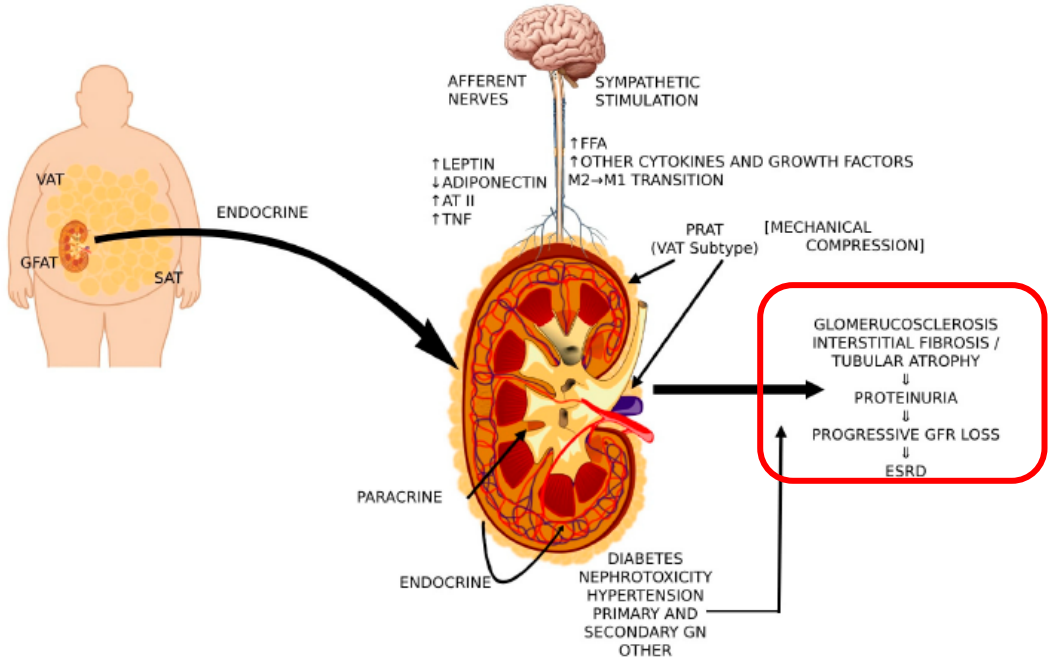
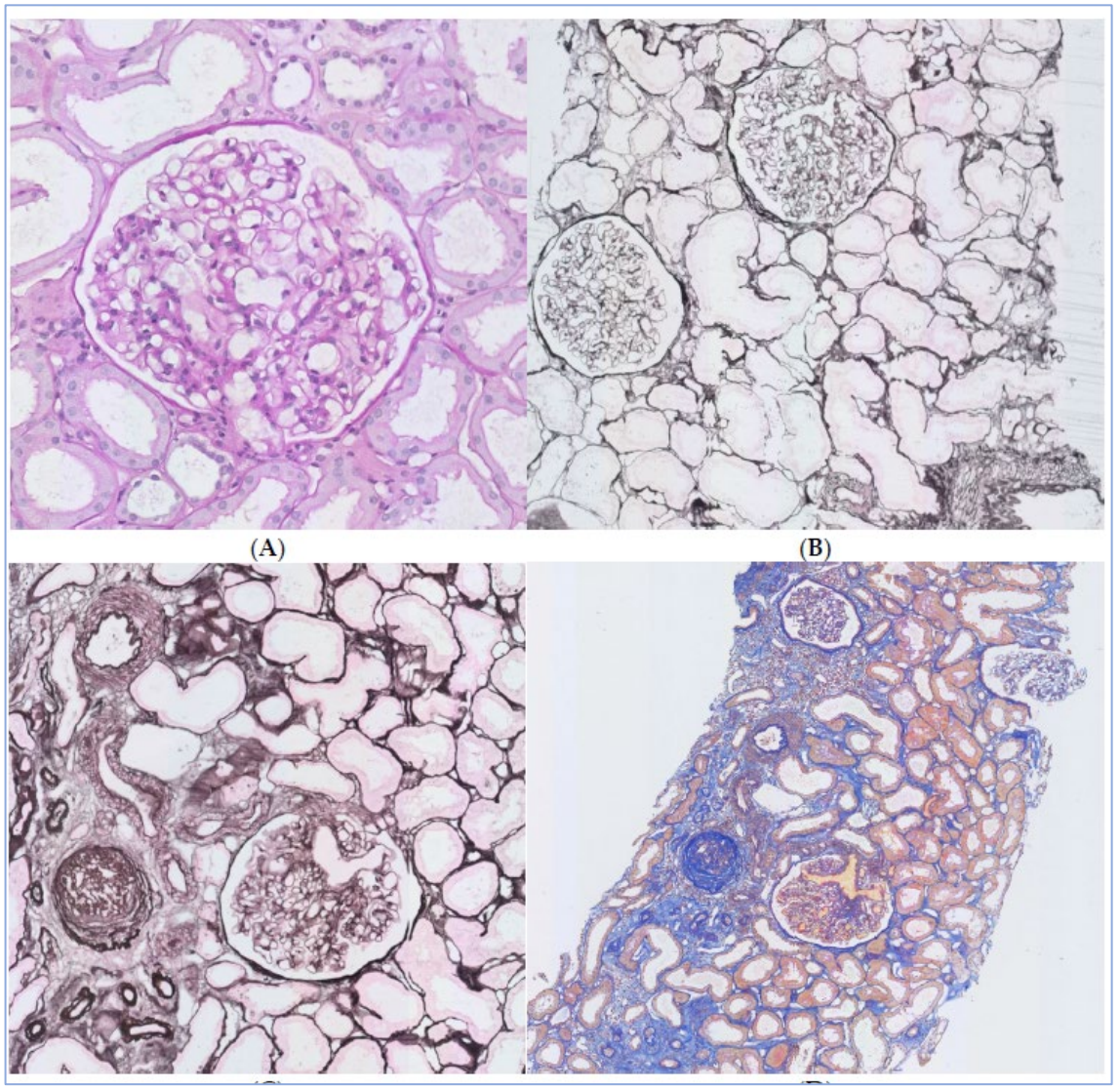


Figure 2. Cross-talk between PRAT, VAT, central nervous system, and sympathetic activity that contributes to renal injury in overweight/obesity [VAT, visceral adipose tissue; GFAT, gluteal-femoral adipose tissue; SAT, subcutaneous adipose tissue; AT II, angiotensin II; TNF, tumor necrosis factor; FFA, free fatty acids; PRAT, perirenal adipose tissue].



Glomerular hyperfiltration: A new marker of metabolic risk

M Tomaszewski[1,2,5], FJ Charchar[3], C Maric[4], J McClure[1], L Crawford[1], W Grzeszczak[2], N Sattar[1], E Zukowska-Szczechowska[2] and AF Dominiczak[1]

Kidney Int 2007; 71:816

Table 3 | Crude and adjusted odds ratios of glomerular hyperfiltration in relation to metabolic risk factors

Variable	Crude		Multivariate-adjusted model 1		Multivariate-adjusted model 2	
	Odds ratio (95% CI)	*P*-value	Odds ratio (95% CI)	*P*-value	Odds ratio (95% CI)	*P*-value
↑BP	2.8 (1.7–4.7)	<0.0001	1.9 (1.1–3.2)	0.026	1.8 (1.0–3.0)	0.047
↑Glucose	1.3 (0.6–3.0)	0.483	0.9 (0.4–2.2)	0.887	0.8 (0.3–2.1)	0.703
↓HDL	3.1 (1.8–5.2)	<0.0001	2.5 (1.5–4.4)	0.001	2.5 (1.5–4.3)	0.001
↑TG	3.2 (1.9–5.6)	<0.0001	1.6 (0.9–2.9)	0.138	1.6 (0.9–3.1)	0.124
↑BMI	8.6 (5.1–14.5)	<0.0001	6.4 (3.7–11.2)	<0.0001	6.6 (3.8–11.6)	<0.0001

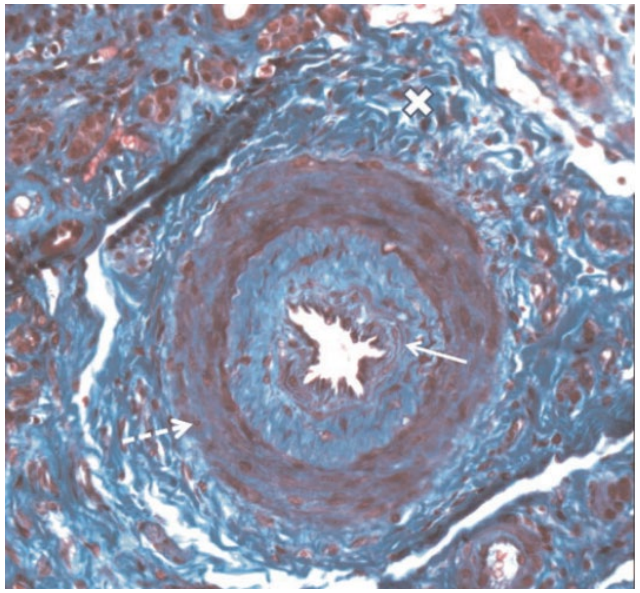
↑BMI, body mass index ⩾25 kg/m^2; ↑BP, blood pressure ⩾130/85 mm Hg or antihypertensive treatment; ↑Glucose, serum glucose ⩾6.1 mmol/l; ↓HDL, HDL-cholesterol levels <1.04 mmol/l; ↑TG, triglyceride levels ⩾1.7 mmol/l.
Model 1: BP, glucose, HDL, TG, and BMI included as covariates.
Model 2: BP, glucose, HDL, TG, BMI, age, alcohol consumption, smoking, and log insulin serum concentrations included as covariates.

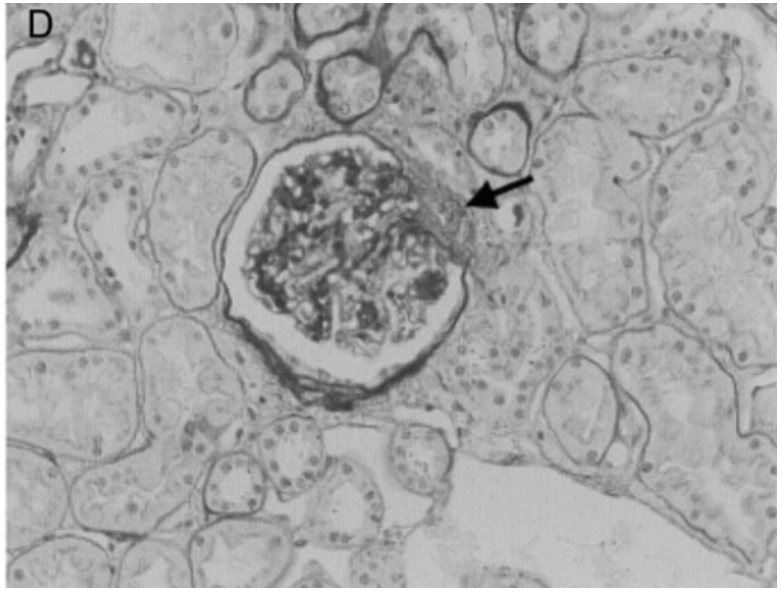
Nephrosclerosis: update on a centenarian

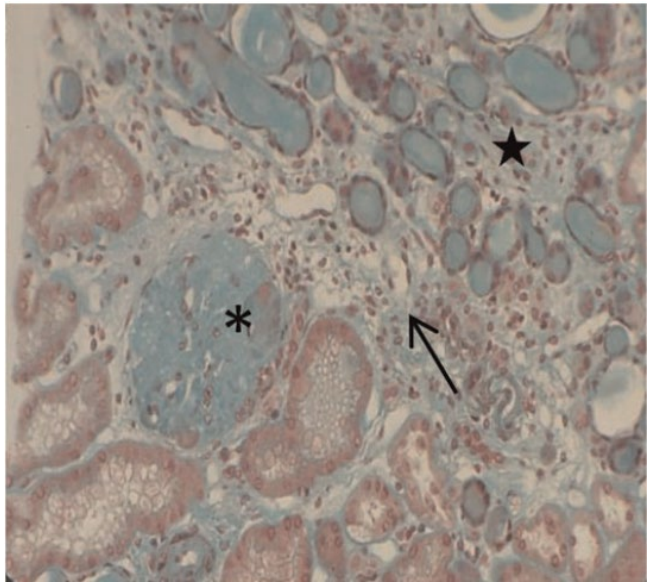
Alain Meyrier[1,2]

[1]Université Paris-Descartes, Paris, France and [2]Département de Néphrologie, Hôpital Georges Pompidou (AP-HP), Paris, France

Nephrol Dial Transplant 2015; 30:1833







The American Journal of Pathology, Vol. 192, No. 12, December 2022

ELSEVIER

The American Journal of PATHOLOGY

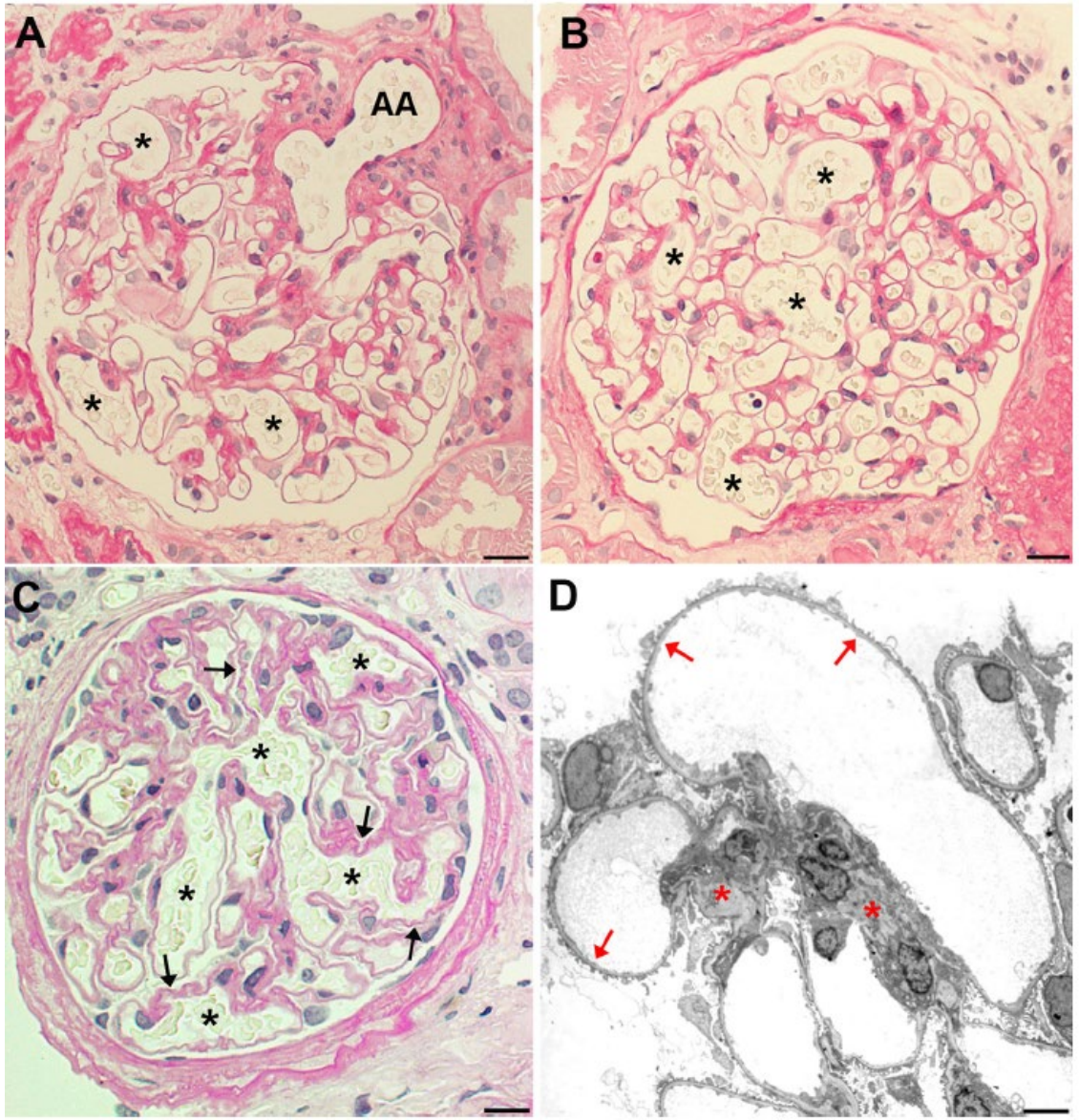
ajp.amjpathol.org

CARDIOVASCULAR, PULMONARY, AND RENAL PATHOLOGY

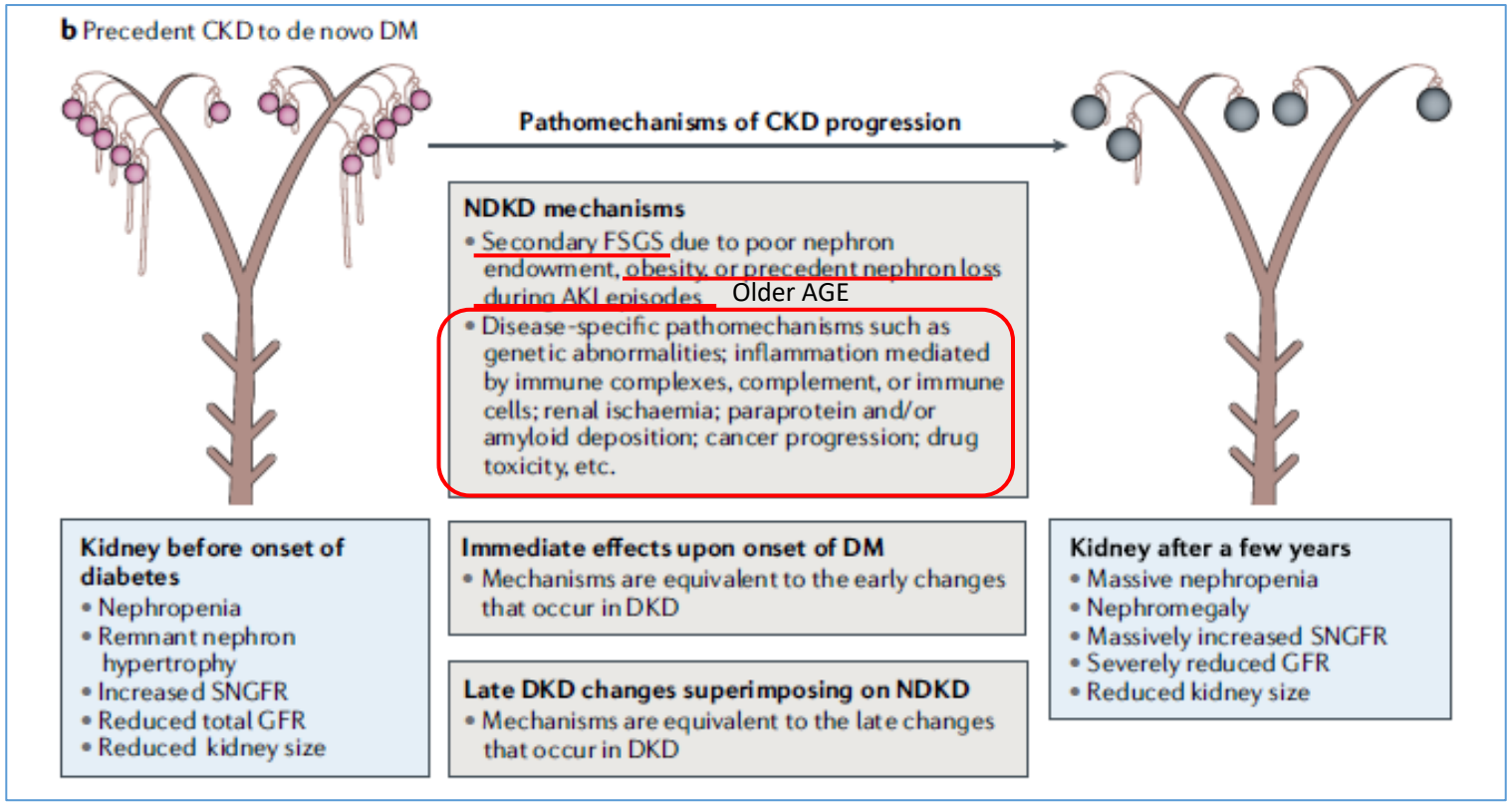
Mesangial Injury and Capillary Ballooning Precede Podocyte Damage in Nephrosclerosis

Wilhelm Kriz,* Thorsten Wiech,† and Hermann-Josef Gröne‡§

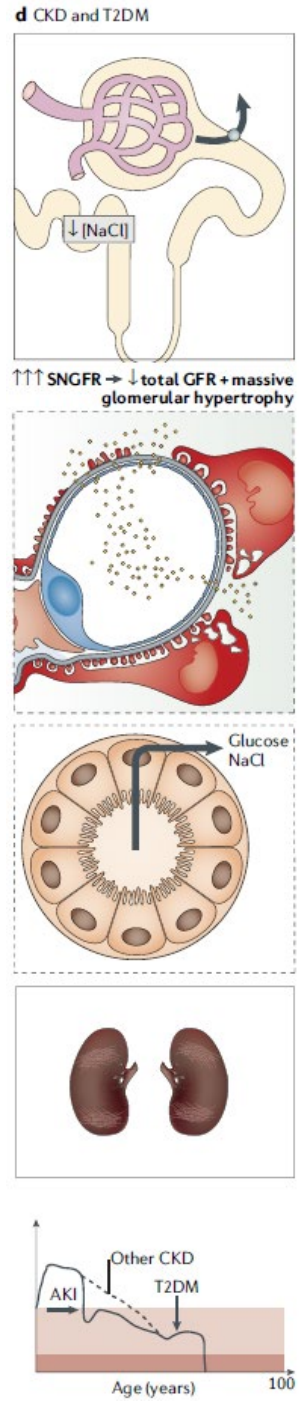
Am J Pathol 2022; 192:1670



Non Diabetic Kidney Disease associated to Diabetes



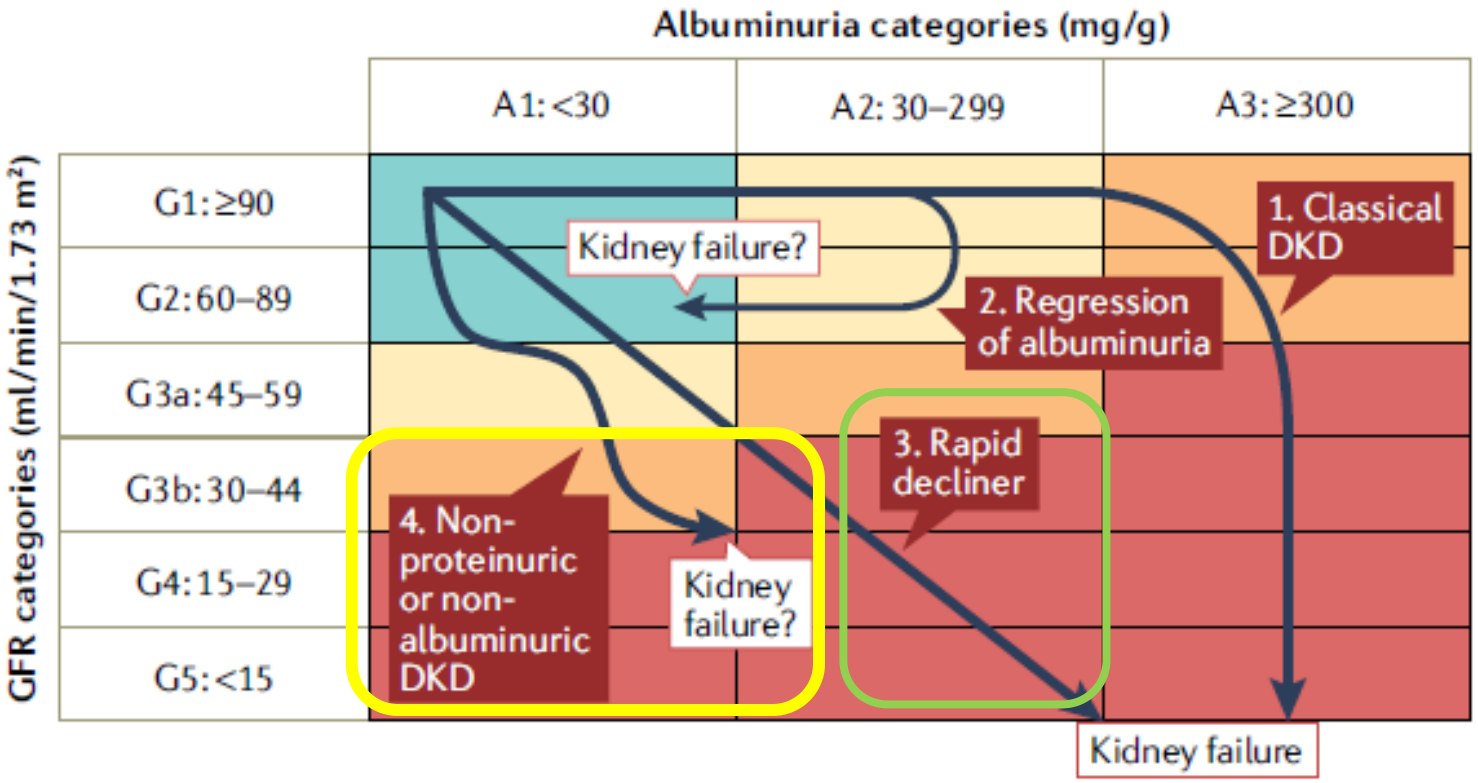
Anders HJ et al Nature Rev Nephrol 2018; 14:361



Trajectories of kidney function in diabetes: a clinicopathological update

Nature Rev Nephrol 2021; 17: 740

Megumi Oshima[1,4], Miho Shimizu[1,4], Masayuki Yamanouchi[1,2,4], Tadashi Toyama[1], Akinori Hara[1], Kengo Furuichi[3] and Takashi Wada[1]



- The prevalence of phenotypes 4 is 20 % or 40 % in type 1 and type 2 diabetes respectively

- Absence of macroalbuminuria and retinopathy with decrease of GFR may be associated to nephrovascular disease or interstitial nephritis

- Phenotype 3:Risk factors for Rapid GFR Decline (decrease ≥5 ml/min /year) include high GFR, High systolic blood pressure and macroalbuminuria

- These patiets might have Non Diabetic Kidney Disease

Table 1 | **Findings from kidney biopsy studies of patients with CKD and diabetes mellitus**

Region and country	n	DKD (%)	NDKD (%)	DKD + NDKD (%)	Refs
North America					
USA	620	37	36	27	12
	31	42	19	39	127
	233	28	53	19	128
	6,000	63	37	NR	H. Liapis, unpublished observations
USA (Pima Indians)	111	100	NR	NR	114
Europe–Central Asia					
Italy	393	40	43	17	129
Austria	567	68	17	NR	106
	84	79	22	NR	130
UK	68	61	32	3	131
	26	85	15	NR	132
Denmark	35	77	20	3	133
	51	69	14	NR	134
France	21	62	38	NR	135
Spain	110	34	62	4	136
	35	74	17	9	137
	20	45	55	NR	138
Czech Republic	163	42	48	10	139

Anders HJ et al Nature Rev Nephrol 2018; 14:361

PLOS ONE 2013; 8

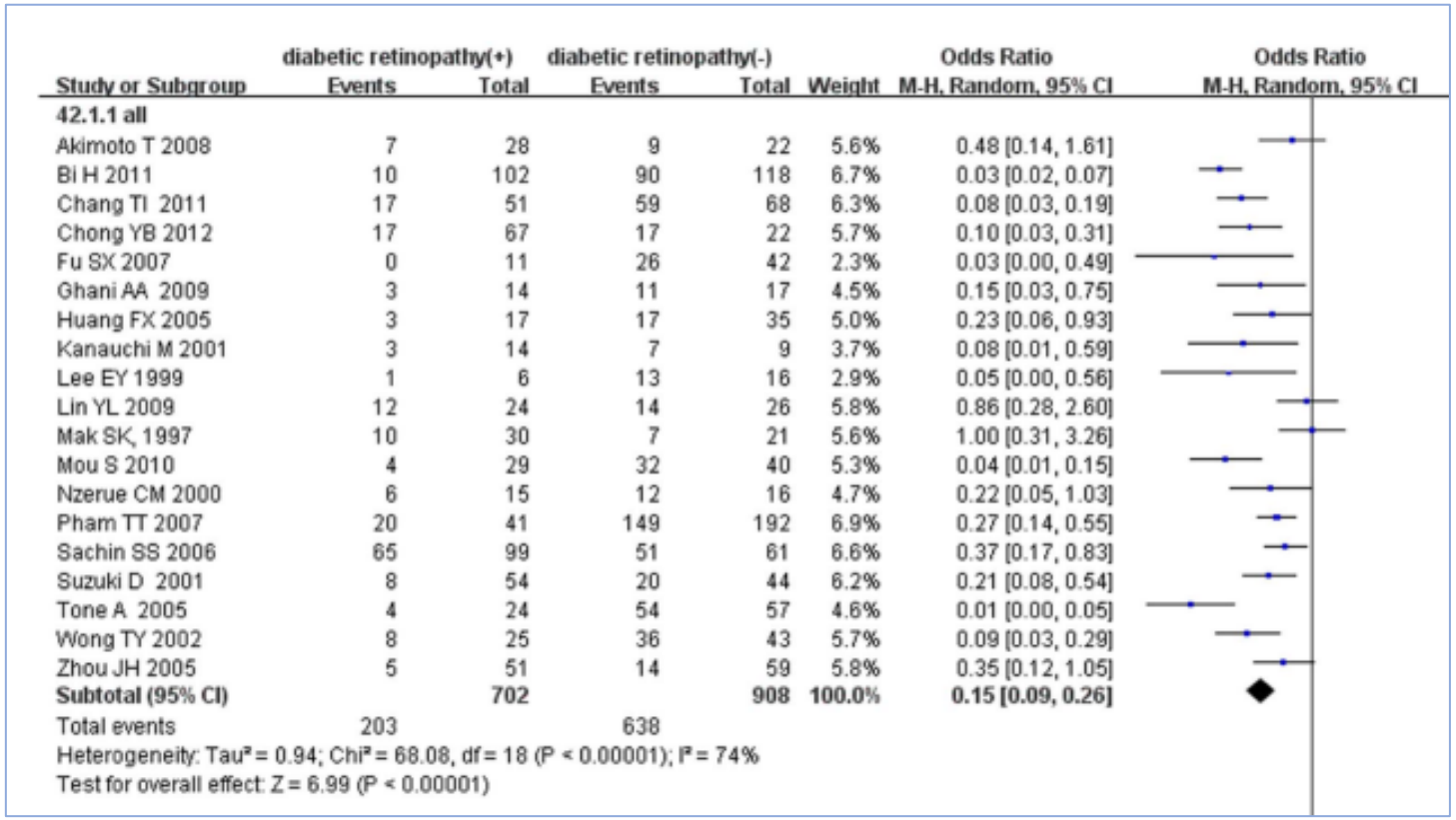
OPEN ACCESS Freely available online

PLOS ONE

Identifying Parameters to Distinguish Non-Diabetic Renal Diseases from Diabetic Nephropathy in Patients with Type 2 Diabetes Mellitus: A Meta-Analysis

Shuang Liang, Xue-Guang Zhang, Guang-Yan Cai*, Han-Yu Zhu, Jian-Hui Zhou, Jie Wu, Pu Chen, Shu-peng Lin, Qiang Qiu, Xiang-Mei Chen*

Meta-analysis on Non Diabetic Renal Disease and Diabetic Nephropathy associated with diabetic retinopathy (diagnosed with renal biopsy) in Type 2 Diabetes



Study or Subgroup	diabetic retinopathy(+) Events	Total	diabetic retinopathy(-) Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
42.1.1 all						
Akimoto T 2008	7	28	9	22	5.6%	0.48 [0.14, 1.61]
Bi H 2011	10	102	90	118	6.7%	0.03 [0.02, 0.07]
Chang TI 2011	17	51	59	68	6.3%	0.08 [0.03, 0.19]
Chong YB 2012	17	67	17	22	5.7%	0.10 [0.03, 0.31]
Fu SX 2007	0	11	26	42	2.3%	0.03 [0.00, 0.49]
Ghani AA 2009	3	14	11	17	4.5%	0.15 [0.03, 0.75]
Huang FX 2005	3	17	17	35	5.0%	0.23 [0.06, 0.93]
Kanauchi M 2001	3	14	7	9	3.7%	0.08 [0.01, 0.59]
Lee EY 1999	1	6	13	16	2.9%	0.05 [0.00, 0.56]
Lin YL 2009	12	24	14	26	5.8%	0.86 [0.28, 2.60]
Mak SK, 1997	10	30	7	21	5.6%	1.00 [0.31, 3.26]
Mou S 2010	4	29	32	40	5.3%	0.04 [0.01, 0.15]
Nzerue CM 2000	6	15	12	16	4.7%	0.22 [0.05, 1.03]
Pham TT 2007	20	41	149	192	6.9%	0.27 [0.14, 0.55]
Sachin SS 2006	65	99	51	61	6.6%	0.37 [0.17, 0.83]
Suzuki D 2001	8	54	20	44	6.2%	0.21 [0.08, 0.54]
Tone A 2005	4	24	54	57	4.6%	0.01 [0.00, 0.05]
Wong TY 2002	8	25	36	43	5.7%	0.09 [0.03, 0.29]
Zhou JH 2005	5	51	14	59	5.8%	0.35 [0.12, 1.05]
Subtotal (95% CI)		**702**		**908**	**100.0%**	**0.15 [0.09, 0.26]**
Total events	203		638			

Heterogeneity: $Tau^2 = 0.94$; $Chi^2 = 68.08$, df = 18 ($P < 0.00001$); $I^2 = 74\%$

Test for overall effect: $Z = 6.99$ ($P < 0.00001$)

Presence of Hematuria OR 2.05 (95 % CI 1.25-3.36)
p = 0.004

clinical nephrology
Original
©2024 Dustri-Verlag Dr. K. Feistle
ISSN 0301-0430

Determinants of non-diabetic kidney diseases in type 2 diabetic patients: Twenty years of single center experience

Clin Nephrol 2024; 5: 207

Tamer Sakaci[1]*, Elbis Ahbap[1]*, Taner Basturk[1], Mustafa Ortaboz[1], Ayse Aysim Ozagari[2], Emrah Erkan Mazı[1], Kamile Gulcin Eken[2], Nuri Baris Hasbal[3], and Abdulkadir Unsal[1]

Table 1. Indications for kidney biopsy in patients with type 2 diabetes.

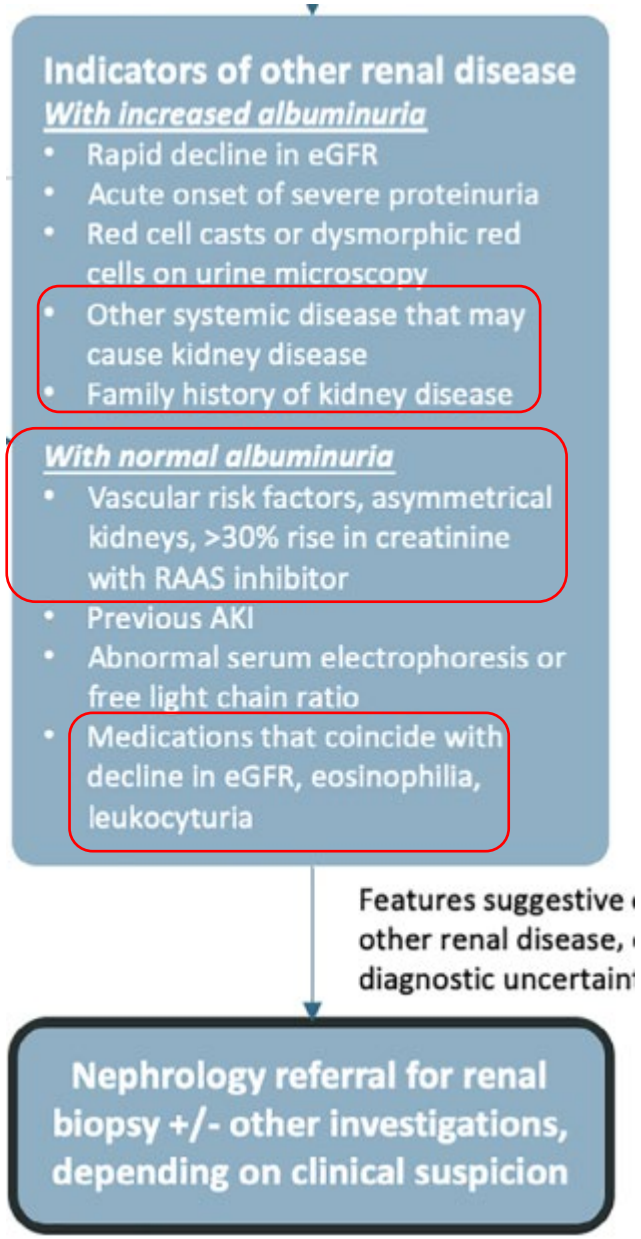
Signs and symptoms of suspected nondiabetic cause for kidney disease
Atypical presentations of renal function loss 1. AKI/RPKD: Patients with an exceptionally rapid decline in kidney function (severe AKI, rapidly progressive kidney failure), in case of excluding reversible causes of AKI. 2. Unexplained RF without AKI/RPKD: – Patients with kidney failure who have a shorter duration of diabetes, absence of diabetic retinopathy and less than moderately increased Hba1c level at the time of diagnosis (if there are no other causes for kidney failure). – An unusual decline in kidney function (an apparent and persistent increase of yearly eGFR decline to more than 5 mL/min/1.73m^2).
Atypical presentations of proteinuria 1. ANS/ANP: Sudden and rapid onset of proteinuria (acute nephrotic syndrome or development of nephrotic range proteinuria without previous moderately increased albuminuria) 2. ANNP: Patients with apparent non-nephrotic proteinuria, who has a shorter duration of diabetes, absence of diabetic retinopathy, and/or rapid increase in proteinuria level, especially with a Hba1c level of less than 7.5% at the time of diagnosis.
SNS or SNP 1. Patients with severe proteinuria of more than 8 g/day with or without nephrotic syndrome.
Unusual urine sediment 1. Hematuria: Patients who have persistent microscopic hematuria with either > 1 g/day proteinuria or increase in serum creatinine level. 2. Active nephritic urinary sediment: Patients who have active urine sediment with signs and symptoms suggestive of acute TIN or nephritic syndrome.

RPKD = rapidly progressive kidney dysfunction; AKI = acute kidney injury; RF = renal failure; ANS/ANP = atypical presentations of nephrotic syndrome or nephrotic range proteinuria; SNS/SNP = severe nephrotic syndrome/severe nephrotic proteinuria; ANNP = atypical presentations of non-nephrotic proteinuria; TIN = tubulointerstitial nephritis.

- **N 159 patients with type 2 DM underwent a kidney biopsy**

- **64.8 % isolated NDN**
- **25.1 % isolated DN**
- **10.1 % mixed nephropathy**

Selby NM Diabetes Obes Metab 2019; 22:113



NEPHROLOGY - ORIGINAL PAPER

Int Urol Nephrol 2023;55:2303

Clinico-pathological features of diabetic and non-diabetic renal diseases in type 2 diabetic patients: a retrospective study from a 10-year experience in a single center

Yuemeng Sun[1] · Yawei Ren[2] · Ping Lan[2] · Xiaoyang Yu[2] · Jie Feng[2] · Dapeng Hao[2] · Liyi Xie[2]

Table 1 NDRD identified in complicated group and non-DN group

Disease spectrum	NDRD ($n=179$)%	DN + NDRD($n=37$)
Membranous nephropathy	56 (31.3)	9 (24.3%)
Mesangial proliferative glomerulonephritis	47 (26.3)	10 (27.0%)
IgA nephropathy	38 (21.2)	5 (13.5%)
Focal segmental glomerulosclerosis	19 (10.6)	5 (13.5%)
Acute interstitial nephritis	6 (3.35)	5 (13.5%)
ANCA-associated vasculitis	4 (2.23)	1 (2.7%)
Amyloidosis	3 (1.68)	1 (2.7%)
Henoch–Schonlein Purpura nephritis	2 (1.12)	0
Lupus nephritis	1 (0.56)	0
Membranous proliferative glomerulonephritis	1 (0.56)	1 (2.7%)
Others	2 (1.12)	0

Table 3 Multi-variable logistic regression analysis for diabetic nephropathy as dependent variable

	B ± E	*P* value	Odds ratio	95% CI for Odds ratio
Male	–	> 0.05	1.44	0.56–3.68
Age > 65 y	–	> 0.05	1.15	0.39–3.33
SCr > 97 umol/L	2.213 ± 0.422	< 0.001	9.15	4.00–20.91
Proteinuria > 3.5 g/24 h	–	> 0.05	1.66	0.96–2.87
Presence of hypertension	–	> 0.05	0.42	0.1–1.06
Absence of Hematuria	1.072 ± 0.366	0.003	2.92	1.43–5.99
Time since diabetes diagnosis > 60 months	0.769 ± 0.338	0.023	2.16	1.11–4.19
Presence of retinopathy	2.162 ± 0.362	< 0.001	27.6	10.55–72.33

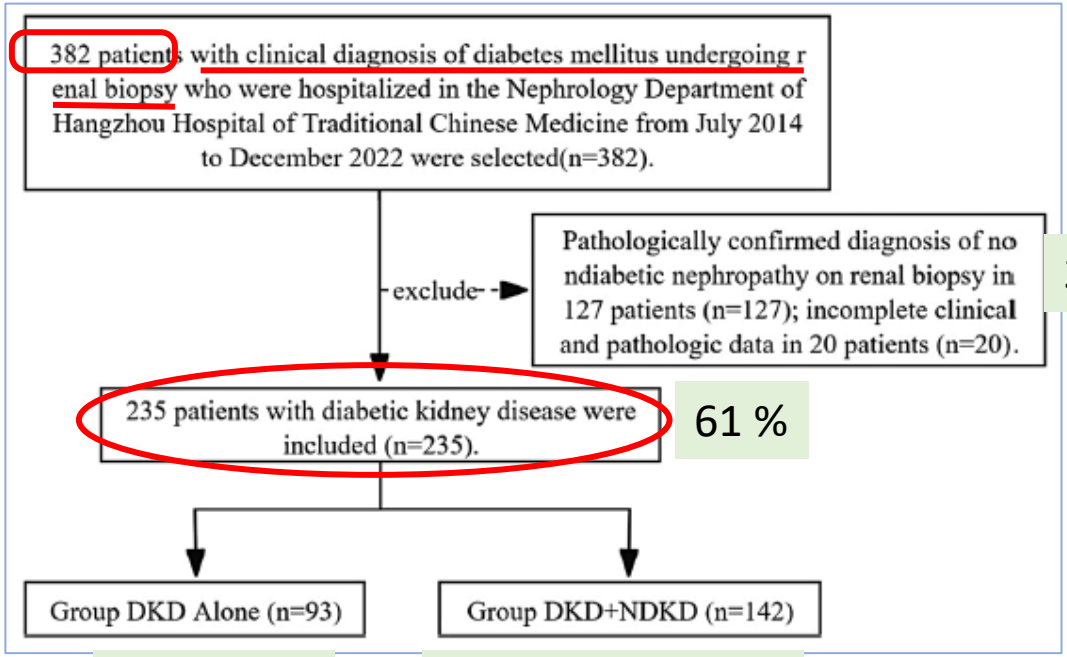
SCr serum creatinine, *CI* Confidence interval

RESEARCH Open Access

Characterization of diabetic kidney disease in 235 patients: clinical and pathological insights with or without concurrent non-diabetic kidney disease

BMC Nephrology 2025; 26:29

Mengjie Jiang[1], Hongyu Chen[1], Jing Luo[1], Jinhan Chen[2], Li Gao[1] and Qin Zhu[1*]



33 % NDKD

61 %

24 % DKD

37 % DKD+NDKD

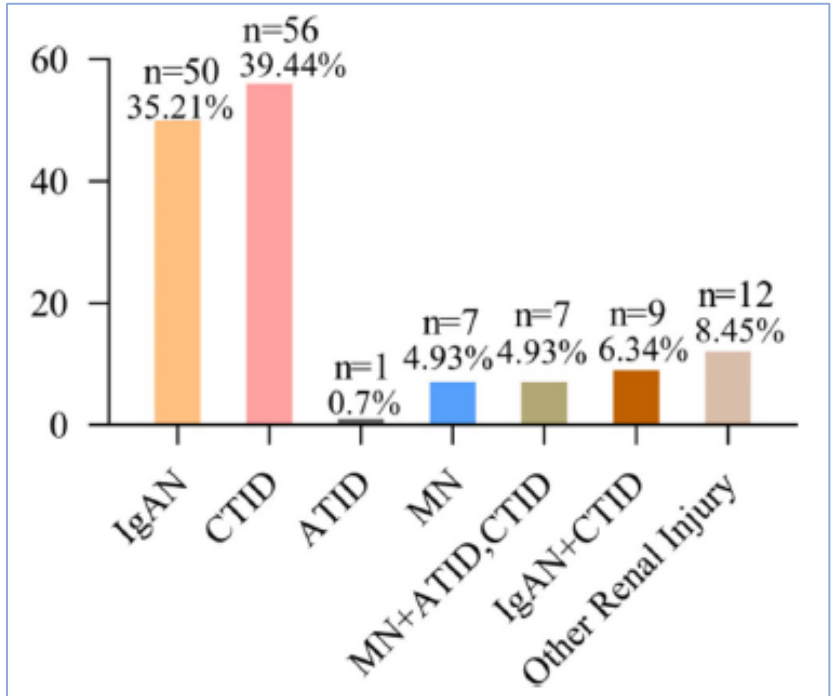
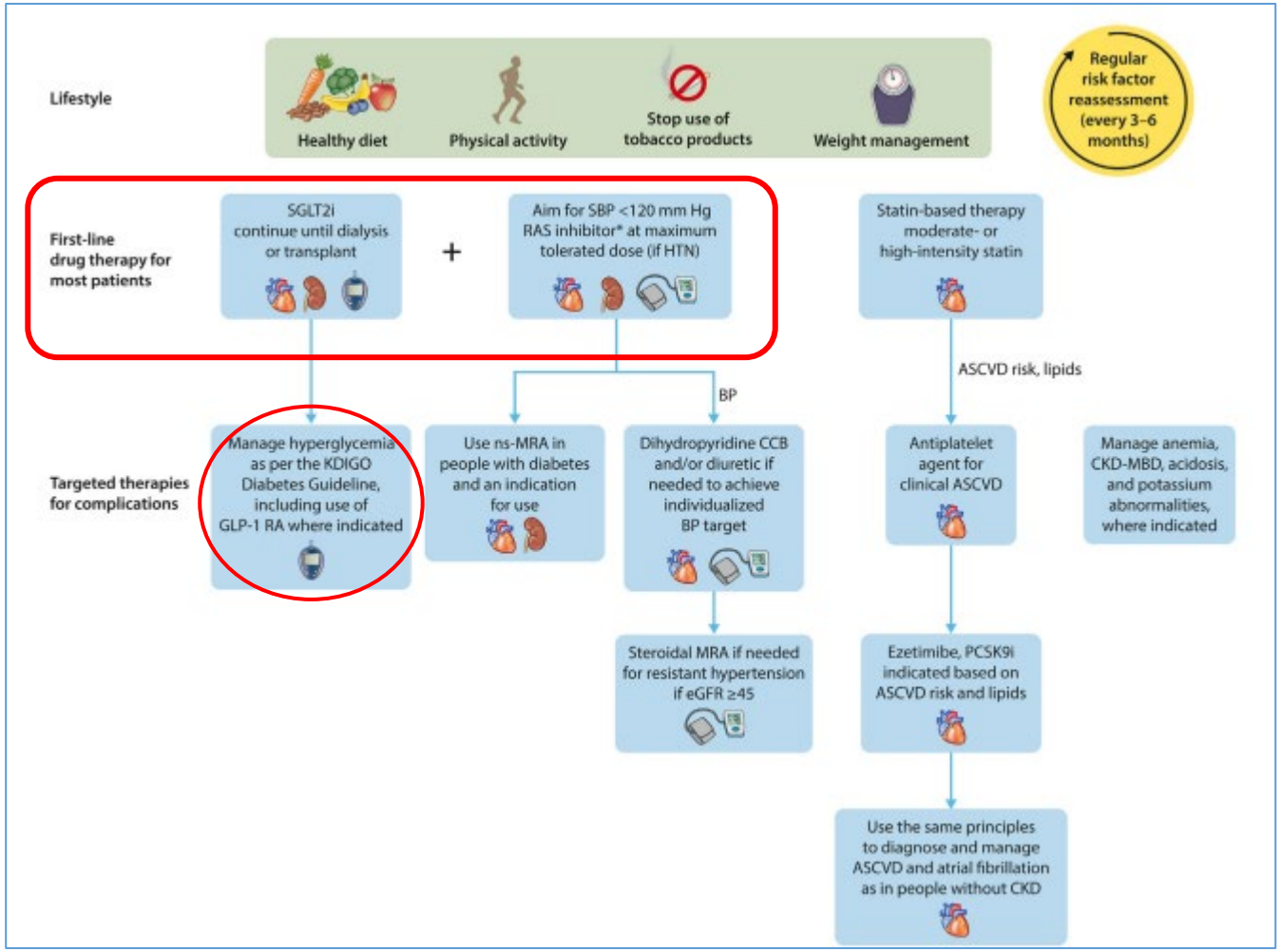


Fig. 3 Pathology of DKD + NDKD group. Note: Legend depicts renal pathology. IgA nephropathy (IgAN); Acute tubulointerstitial disease (ATID); Chronic tubulointerstitial disease (CTID); Membranous nephropathy (MN)

KDOQI US Commentary on the KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of CKD

AJKD 2025; 85: 135

KDIGO 2024 CLINICAL PRACTICE GUIDELINE FOR THE EVALUATION AND MANAGEMENT OF CHRONIC KIDNEY DISEASE



Subgroup analysis of primary endpoint: Summary of other key subgroups

ORIGINAL ARTICLE

Empagliflozin in Patients with Chronic Kidney Disease

The EMPA-KIDNEY Collaborative Group*

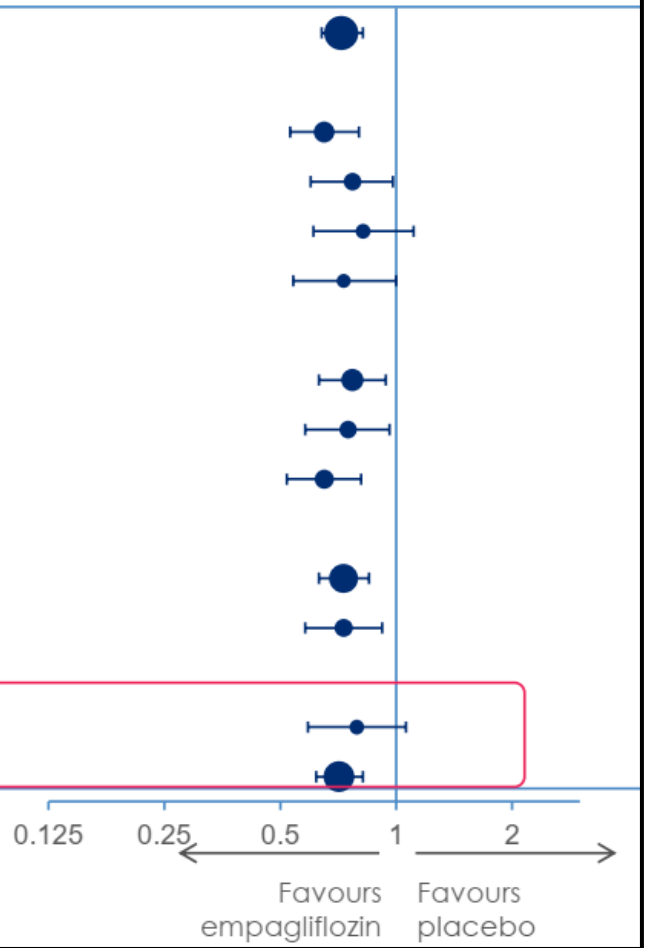
ABSTRACT

Composite Primary End Point of EMPA Kidney

- Sustained GFR decline ≥40 ml/min/1.73 m2
- ESRD/Dialysis
- CV or Kidney Disease related mortality

Mean Follow up 2.0 years

Subgroup Category	Empagliflozin 10 mg	Placebo	HR (95% CI)
	n with event / N analysed		
Overall	432/3304	558/3305	0.72 (0.64, 0.82)
Cause of kidney disease			
Diabetic kidney disease 31. %	161/1032	223/1025	0.65 (0.53, 0.80)
Glomerular disease 25. %	117/853	142/816	0.77 (0.60, 0.98)
Hypertensive/renovascular disease 22 %	82/706	96/739	0.82 (0.61, 1.11)
Other/unknown 18 %	72/713	97/725	0.73 (0.54, 1.00)
Baseline HbA1c, mmol/mol			
<39	183/1329	229/1353	0.77 (0.63, 0.94)
≥39 to <48	114/998	134/953	0.75 (0.58, 0.96)
≥48	135/977	195/999	0.65 (0.52, 0.81)
Prior CV disease			
No	310/2443	388/2401	0.73 (0.63, 0.85)
Yes	122/861	170/904	0.73 (0.58, 0.92)
RAS-inhibition use at randomisation			
No	81/473	98/508	0.79 (0.59, 1.06)
Yes	351/2831	460/2797	0.71 (0.62, 0.82)



Kidney disease progression includes ESKD, sustained eGFR decline of ≥40% or to <10 mL/min/1.73m2 or adjudicated renal death.
Events confirmed or unrefuted by adjudication are considered as an endpoint event.
CV, cardiovascular; HbA1c, glycated haemoglobin; RAS, renin-angiotensin system

The EMPA-KIDNEY Collaborative Group. N Engl J Med 2022

A pre-specified analysis of the DAPA-CKD trial demonstrates the effects of dapagliflozin on major adverse kidney events in patients with IgA nephropathy

Check for updates

David C. Wheeler[1,2], Robert D. Toto[3], Bergur V. Stefánsson[4], Niels Jongs[5], Glenn M. Chertow[6,7], Tom Greene[8], Fan Fan Hou[9], John J.V. McMurray[10], Roberto Pecoits-Filho[11,12], Ricardo Correa-Rotter[13], Peter Rossing[14,15], C. David Sjöström[4], Kausik Umanath[16,17], Anna Maria Langkilde[4] and Hiddo J.L. Heerspink[5]; for the DAPA-CKD Trial Committees and Investigators

Kidney Int 2021; 100:215

Composite Primary End Point of DAPA Kidney

- Sustained GFR decline > 50 %
- ESRD/Dialysis
- CV or Kidney Disease related mortality

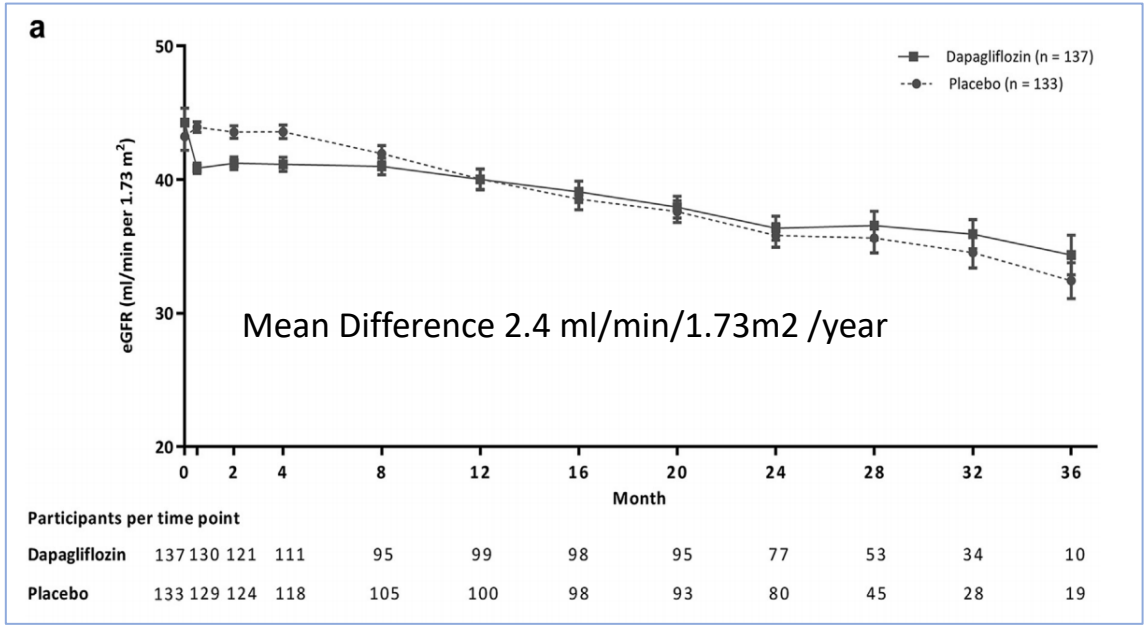
Mean Follow up 2.1 years

Table 1 | Baseline characteristics

Characteristic	Dapagliflozin (n = 137)	Placebo (n = 133)	Total (n = 270)
Age, mean (SD), yr	52.2 (13.1)	50.1 (13.1)	51.2 (13.1)
Female sex, n (%)	44 (32.1)	44 (33.1)	88 (32.6)
Race, n (%)			
White	54 (39.4)	54 (40.6)	108 (40.0)
Black	0 (0)	1 (0.8)	1 (0.4)
Asian	82 (59.9)	77 (57.9)	159 (58.9)
Other	1 (0.7)	1 (0.8)	2 (0.7)
Weight, mean (SD), kg	75.1 (15.4)	78.7 (20.2)	76.8 (18.0)
BMI, mean (SD), kg/m^2	26.3 (4.2)	27.6 (6.1)	27.0 (5.3)
Current smoker, n (%)	13 (9.5)	20 (15.0)	33 (12.2)
Blood pressure, mean (SD), mm Hg			
Systolic	127.7 (16.2)	127.0 (13.9)	127.4 (15.1)
Diastolic	78.7 (11.8)	79.5 (10.1)	79.1 (11.0)
HbA1c, mean (SD), %	5.7 (0.7)	5.6 (0.5)	5.6 (0.6)
Hemoglobin, mean (SD), g/l	133.7 (18.7)	131.3 (15.4)	132.5 (17.2)
Potassium, mean (SD), mmol/l	4.6 (0.5)	4.6 (0.5)	4.6 (0.5)
eGFR, mean (SD), ml/min per 1.73 m^2	44.3 (12.4)	43.2 (12.0)	43.8 (12.2)
Urinary albumin-to-creatinine ratio, median (Q1–Q3), mg/g	889.5 (557.5–1472.0)	902.5 (500.5–1633.0)	900 (539.6–1515.0)
Type 2 diabetes diagnosis, n (%)	24 (17.5)	14 (10.5)	38 (14.1)
History of heart failure, n (%)	4 (2.9)	2 (1.5)	6 (2.2)
Baseline medication, n (%)			
ACE inhibitor	44 (32.1)	41 (30.8)	85 (31.5)
ARB	89 (65.0)	96 (72.2)	185 (68.5)
Diuretic	29 (21.2)	36 (27.1)	65 (24.1)
Statin	68 (49.6)	67 (50.4)	135 (50.0)

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BMI, body mass index; eGFR, estimated glomerular filtration rate; HbA1c, hemoglobin A1c; Q1, quartile 1; Q3, quartile 3.

% Change from baseline in eGFR



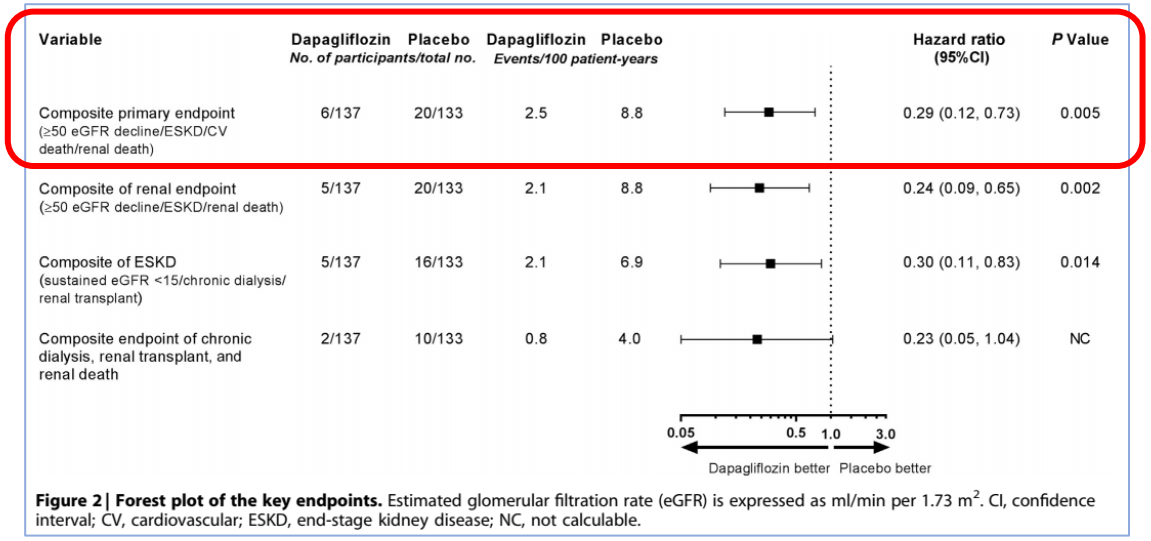
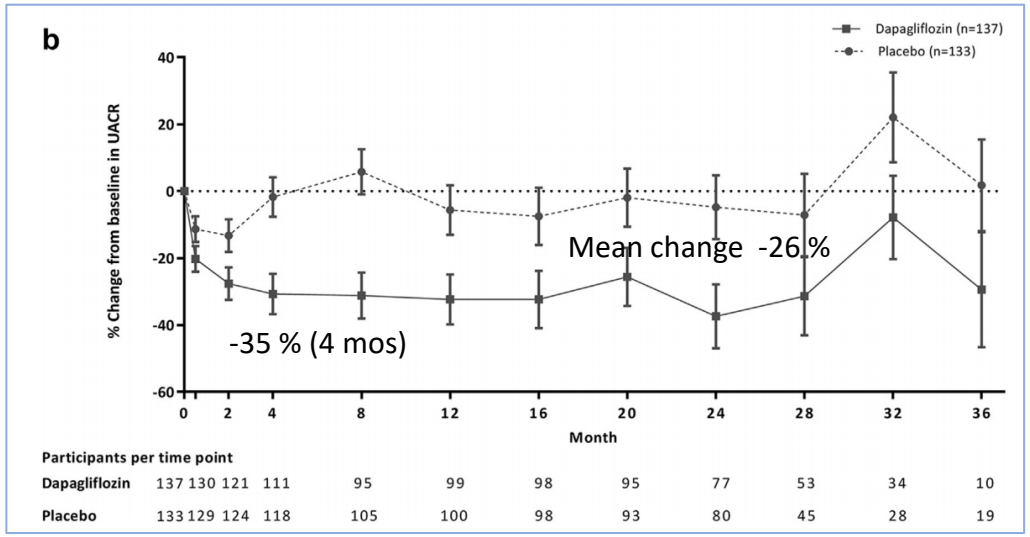


Figure 2| Forest plot of the key endpoints. Estimated glomerular filtration rate (eGFR) is expressed as ml/min per 1.73 m^2. CI, confidence interval; CV, cardiovascular; ESKD, end-stage kidney disease; NC, not calculable.

% Change from baseline in UACR



Wheeler D Kidney Int 2021; 100:215

Nephrol Dial Transplant, 2024, **39**, 328–340
https://doi.org/10.1093/ndt/gfad175
Advance access publication date: 7 August 2023

Sodium-glucose cotransporter 2 inhibition in primary and secondary glomerulonephritis

Fernando Caravaca-Fontán[1], Kate Stevens[2], Maite Padrón[3], Ana Huerta[4], Marco Montomoli[5], Juan Villa[6],

Nephrol Dial Transplant 2024;39:328

Table 1: Clinical characteristics at the time of kidney disease diagnosis.

Characteristic	Total (N = 493)
Baseline	
Age at diagnosis, years	47 (34–59)
Sex, female (%)	157 (32)
Hypertension, *N* (%)	357 (72)
Diabetes mellitus (type 2), *N* (%)	147 (30)
Current smoker, *N* (%)	125 (25)
Previous history of cardiovascular disease, *N* (%)	81 (16)
Glomerular/systemic disease	
Minimal change disease	14 (3)
Primary FSGS	32 (6)
Secondary FSGS	58 (12)
Membranous nephropathy	89 (18)
Immune-complex membranoproliferative glomerulonephritis	18 (4)
C3 glomerulopathy	4 (1)
Post-infectious glomerulonephritis	4 (1)
IgA nephropathy	192 (39)
IgA vasculitis	11 (2)
AL amyloidosis	6 (1)
Cryoglobulinemia	2 (0)
Fibrillary glomerulonephritis	8 (2)
ANCA-associated vasculitis	22 (4)
Anti-glomerular basement membrane disease	1 (0)
Lupus nephritis	32 (7)
Disease chronicity in kidney biopsy	
Glomerulosclerosis	
<10%	219 (44)
10%–25%	165 (34)
26%–50%	79 (16)
>50%	30 (6)
Interstitial fibrosis	
<10%	190 (39)
10%–25%	223 (45)
26%–50%	65 (13)
>50%	15 (3)
Tubular atrophy	
<10%	212 (43)
10%–25%	219 (44)
26%–50%	53 (11)
>50%	9 (2)
Arteriosclerosis	
No	352 (71)
Yes	141 (29)

Data are presented as median (IQR) or *N* (%).

Table 2: Clinical characteristics at the time of SGLT2i initiation.

Characteristic	Total (N = 493)
Baseline	
Age at SGLT2i initiation, years	55 (42–65)
Weight, kg	84 (73–98)
BMI, kg/m^2	29 (26–33)
Weight classification, *N* (%)	
Underweight	5 (1)
Normal	108 (22)
Overweight	183 (37)
Obesity class I	122 (25)
Obesity class II	45 (9)
Obesity class III	30 (6)
RAS blockade, *N* (%)	
ACEi	225 (46)
ARB	253 (51)
Both	15 (3)
Diuretic, *N* (%)	
None	305 (62)
Thiazide-type/thiazide-like	56 (11)
Loop	69 (14)
Aldosterone antagonist	40 (8)
Combinations of diuretics[a]	23 (5)
Maintenance immunosuppression, *N* (%)	79 (16)
Prednisone	46 (9)
Mycophenolate mofetil	42 (8)
Calcineurin inhibitor	19 (4)
Other[b]	14 (3)
Onset of SGLT2i	
Type of SGLT2i, *N* (%)	
Dapagliflozin	386 (78)
Empagliflozin	70 (14)
Canagliflozin	37 (8)
Systolic blood pressure, mmHg	134 ± 17
Diastolic blood pressure, mmHg	78 ± 11
Serum creatinine, mg/dL	1.4 (1–1.9)
eGFR, mL/min/1.73m^2	56 (39–82)
Serum albumin, g/dL	3.9 (3.5–4.3)
UACR, mg/g[c]	1287 (729–2294)
24-h proteinuria, g/day	2.1 (1.2–3.6)
Patients with nephrotic-range proteinuria[d], *N* (%)	130 (26)

Data are presented as mean ± SD, median (IQR) or *N* (%).
[a]Including combination of loop plus thiazide diuretics (50%), thiazide plus aldosterone antagonist (32%) and loop plus aldosterone antagonist (18%).
[b]Including azathioprine in six patients (1%), belimumab in four (1%), maintenance rituximab in three (0.6%), leflunomide in one (0.2%).
[c]Only available in 378 (77%) patients.
[d]Defined as 24-h proteinuria ≥3.5 g/day.
UACR: urinary albumin-to-creatinine ratio

OXFORD ndt

Nephrol Dial Transplant, 2024, **39**, 328–340
https://doi.org/10.1093/ndt/gfad175
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Sodium-glucose cotransporter 2 inhibition in primary and secondary glomerulonephritis

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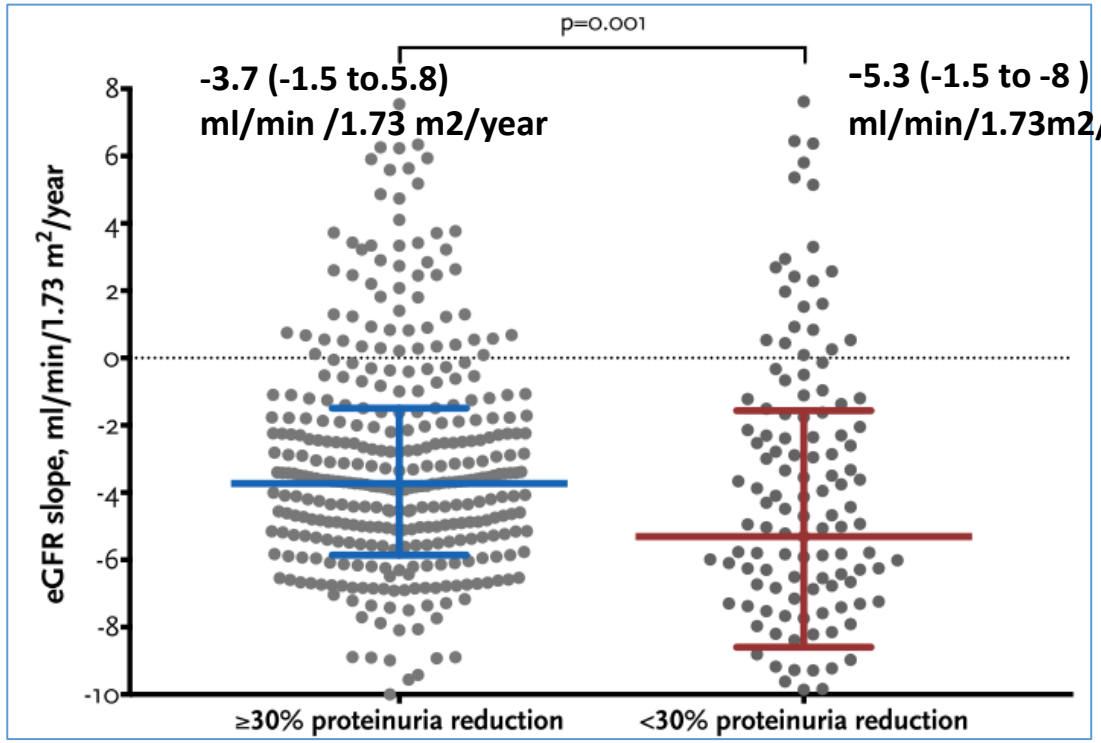
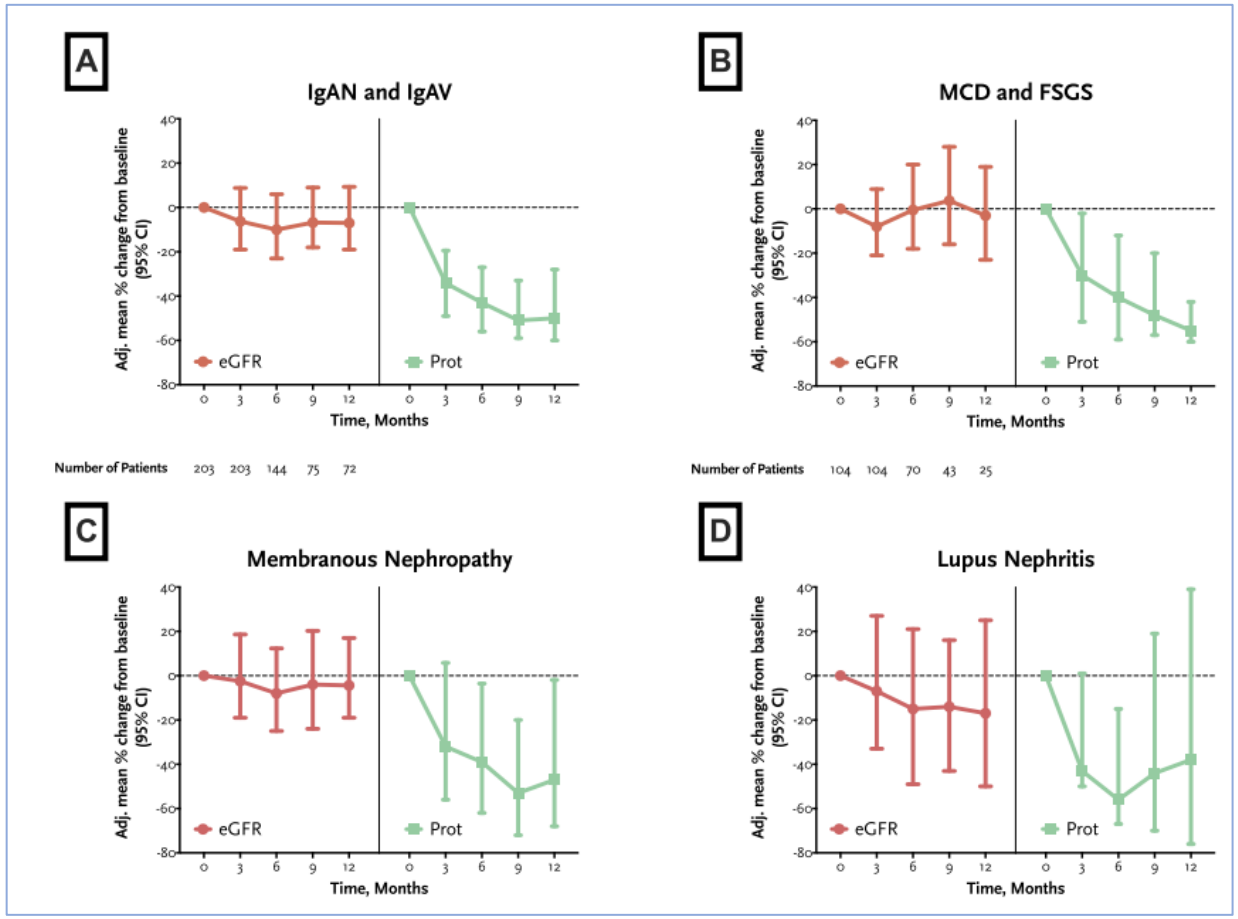




Mean change of proteinuria from baseline: -35 % 3 mos.
-48 % 12 mos.

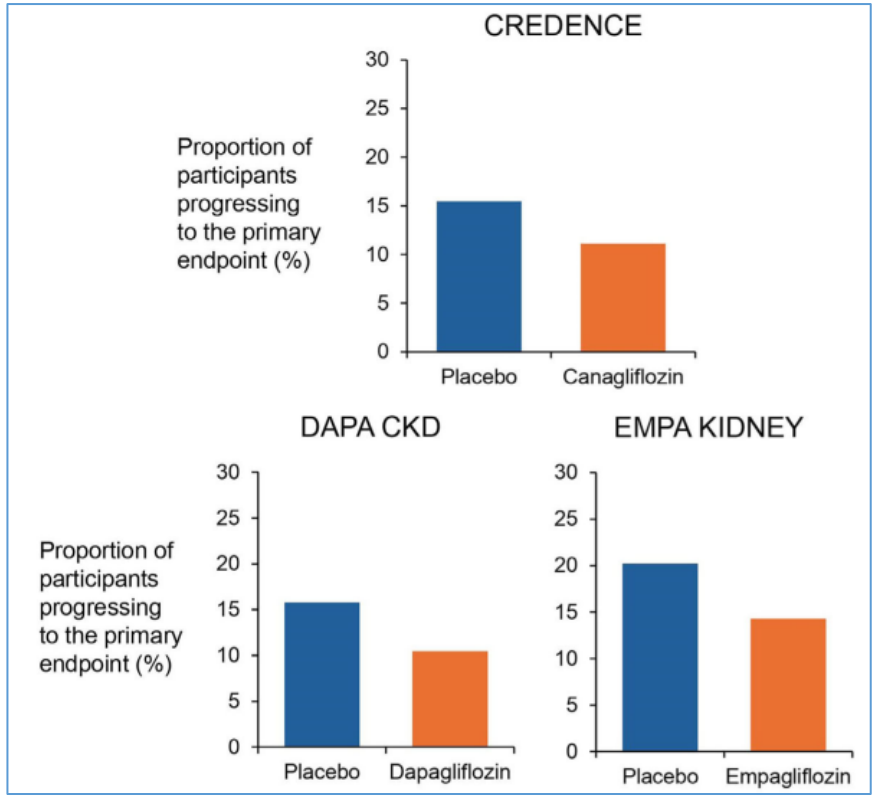
Mean change of eGFR from baseline : -6 % 3 mos.
-10.5 % 12 mos.

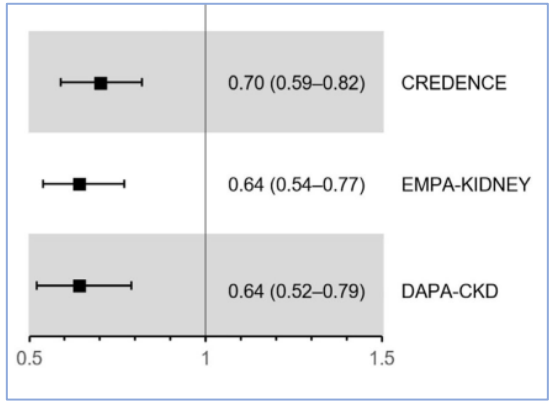
Chronic kidney disease in type 2 diabetes: The size of the problem, addressing residual renal risk and what we have learned from the CREDENCE trial

Diabetes Obes Metab 2024; 26:25

Khuram Chaudhry MBBS[1] | Janaka Karalliedde FRCP[1,2]

Residual risk of CV+Kidney End point



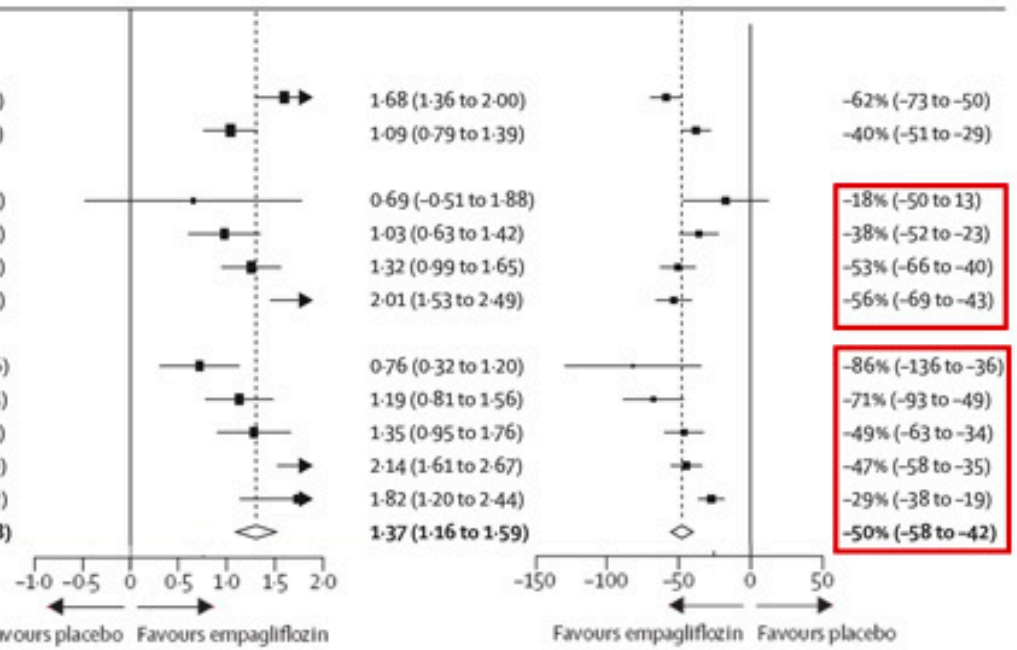


Nephroprotection by SGLT2-I is higher at early stages of CKD

Effects of empagliflozin on progression of chronic kidney disease: a prespecified secondary analysis from the EMPA-KIDNEY trial

- 6609 participants (46% DM, 27% CVD)
- eGFR ≥20 to <45
- ≥45 to <90 with ACR ≥200
- FU 2.0 years
- ✓ Empa: ↓ 29% composite renal risk

	Study average reduction in uACR, %	Mean (SE) slope, mL/min per 1·73 m² per year		Absolute difference (95% CI), mL/min per 1·73 m² per year	Relative difference (95% CI), %
		Empagliflozin	Placebo		
Chronic slope					
Diabetes; χ^2_1=7·17; $p_{heterogeneity}$=0·0074					
Present	−28%	−1·05 (0·12)	−2·73 (0·12)	1·68 (1·36 to 2·00)	−62% (−73 to −50)
Absent	−11%	−1·66 (0·11)	−2·75 (0·11)	1·09 (0·79 to 1·39)	−40% (−51 to −29)
eGFR (mL/min per 1·73 m²); χ^2_1=6·31; p_{trend}=0·012					
<20	5%	−3·08 (0·44)	−3·77 (0·43)	0·69 (−0·51 to 1·88)	−18% (−50 to 13)
20 to <30	−27%	−1·70 (0·14)	−2·73 (0·14)	1·03 (0·63 to 1·42)	−38% (−52 to −23)
30 to <45	−17%	−1·18 (0·12)	−2·50 (0·12)	1·32 (0·99 to 1·65)	−53% (−66 to −40)
≥45	−15%	−1·58 (0·17)	−3·59 (0·17)	2·01 (1·53 to 2·49)	−56% (−69 to −43)
uACR (mg/g); χ^2_1=16·55; p_{trend}<0·0001					
<30	−5%	−0·11 (0·16)	−0·88 (0·16)	0·76 (0·32 to 1·20)	−86% (−136 to −36)
30 to 300	−17%	−0·49 (0·14)	−1·68 (0·14)	1·19 (0·81 to 1·56)	−71% (−93 to −49)
>300 to <1000	−32%	−1·42 (0·14)	−2·78 (0·15)	1·35 (0·95 to 1·76)	−49% (−63 to −34)
1000 to <2000	−18%	−2·43 (0·19)	−4·57 (0·20)	2·14 (1·61 to 2·67)	−47% (−58 to −35)
≥2000	−19%	−4·54 (0·23)	−6·36 (0·22)	1·82 (1·20 to 2·44)	−29% (−38 to −19)
All participants	**−19%**	**−1·37 (0·08)**	**−2·75 (0·08)**	**1·37 (1·16 to 1·59)**	**−50% (−58 to −42)**



* From month 2 to the end of follow up

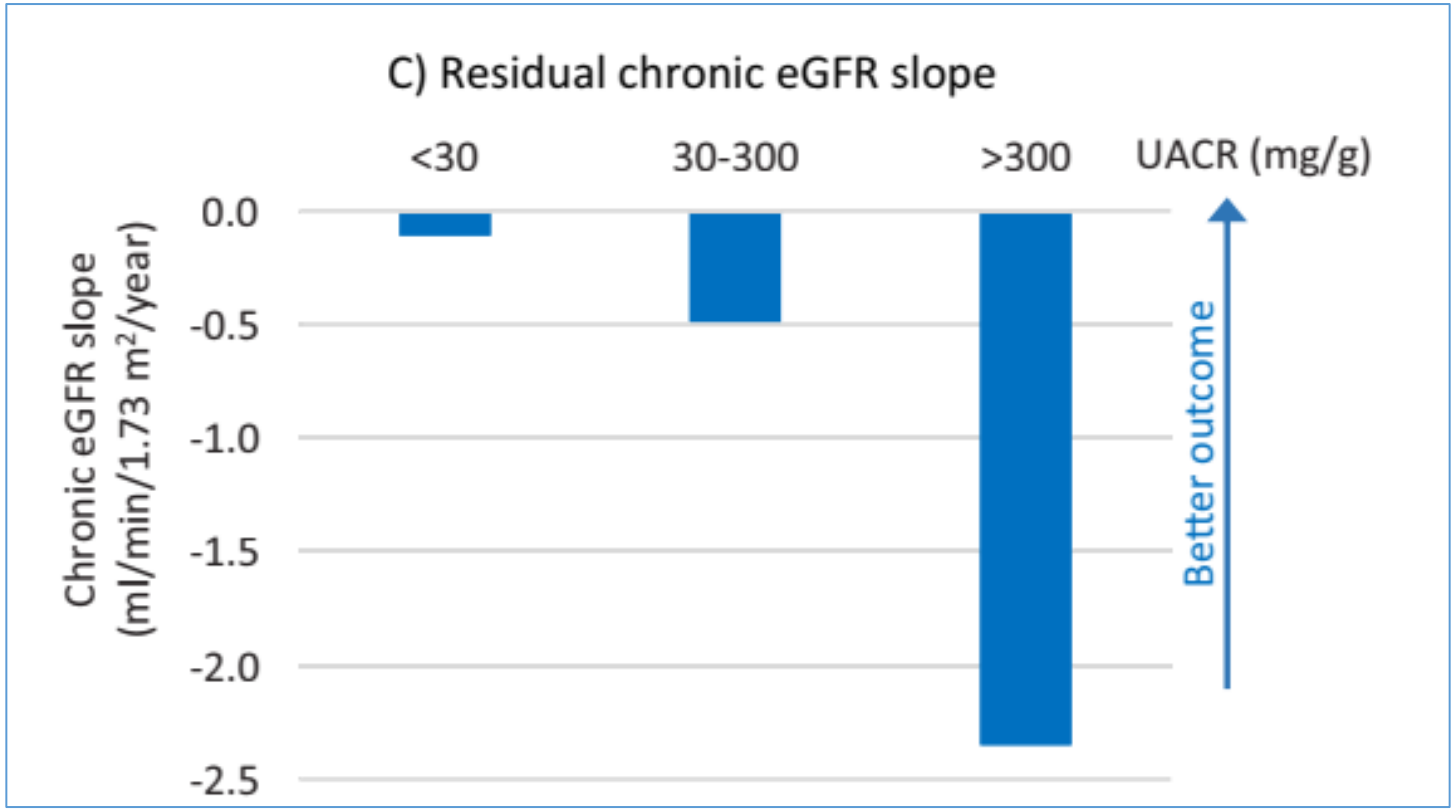
Lancet Diabetes Endocrinol 2024; 12: 39–50

EDITORIAL COMMENT

EMPA-KIDNEY: expanding the range of kidney protection by SGLT2 inhibitors

Beatriz Fernández-Fernandez[1,2,3,4], Pantelis Sarafidis[5], Maria José Soler[2,4,6] and Alberto Ortiz[1,2,3,4]

Clin Kidney J 2023; 16:1187



Conclusioni

- La malattia renale cronica nel diabete (+ nel DMT2) è molto frequentemente associata a danno renale legato a malattia nefrovascolare o al sovrappeso/obesità
- La presenza di patologia renale non diabetica comporta una aggravamento più rapido dell' insufficienza renale e della proteinuria nel diabete
- L'assenza di retinopatia diabetica, la minore durata del diabete (< 5 anni), la presenza di ematuria e/o di sedimento urinario «attivo» sono associate a nefropatia non diabetica
- La biopsia renale va riservata ai casi di insufficienza renale a rapida progressione da sola o associata a proteinuria nefrosica o a sindrome nefrosica
- Le Gliflozine, associate ai RASi, rappresentano la prima linea di terapia nei pazienti diabetici con CKD