Dialysis..Life Giver or Destroyer
By J.B. 15 yo ESRD Patient

Dialysis is like a hungry monster eager for your blood
It is like a dark shadow thrown over you
It seems like it will is never going to end
Dragging on for hours, unable to move
Boring and still
And if you do move
Alarms will sound like when a prisoner is trying to escape

Dialysis is a second life
Dialysis is a life giving angel
Cleaning my blood
Restoring my energy
Dailysis is a gift prolonging my life

It is a battle only few understand, those that do
Are fellow patients
Dialysis

# PROTEINURIA: MARKER/CULPRIT

Kidney Kid
Sierra Nevada Specialty Care
January 2023

- Have Fun
- Learn 1 or 2 things
- Review newer studies

## OBJECTIVES

- Small segment of population
  - 6-8%
  - 150-200mg < proteinuria
- Types of Protein
  - Albumin
  - Tamm–Horsfall
  - Light chain proteins

## PROTEINURIA

- Proteinuria greater 3000mg
- Hypo-albuminemia
- Edema
- Hyperlipidemia

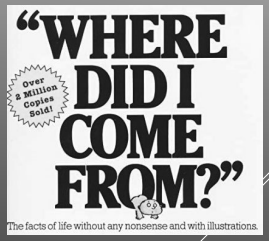
## NEPHROTIC SYNDROME

- Why does proteinuria occur?
- What are the negative effects of proteinuria?
- Edema #$%&@!
- What are some causes of Proteinuria?
- How can we control and improve proteinuria?

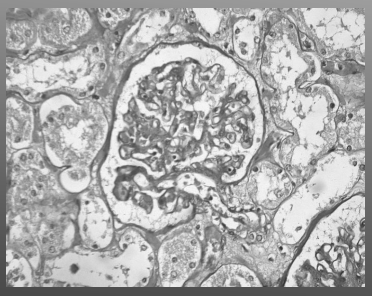
## OUTLINE

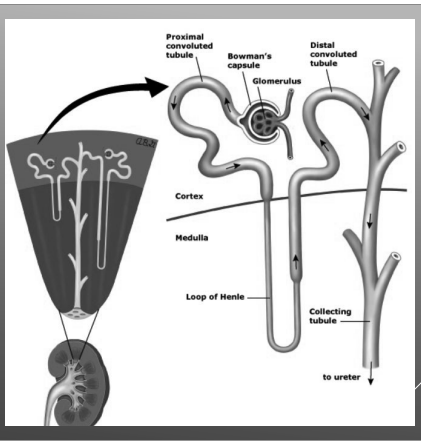
- Where does proteinuria come from?

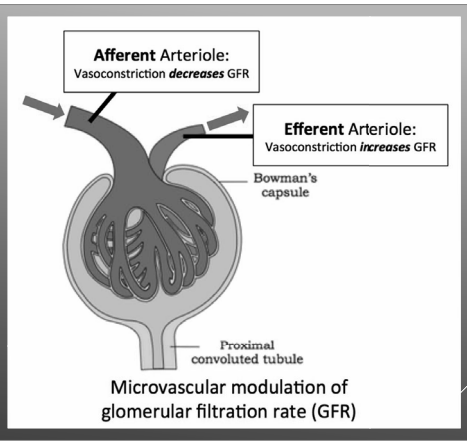
## OUTLINE: PART 1



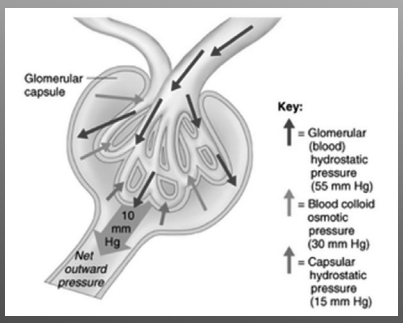

Physiologic Masterpiece





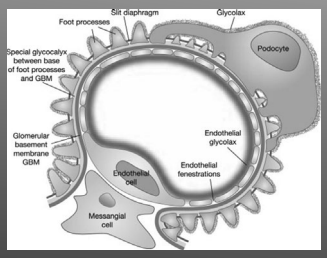



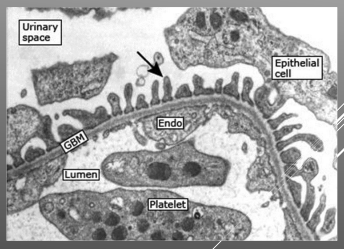

Glomerular Forces




Glomerular Capillary Wall
- Fenestrated Endothelium
- Glomerular Basement Membrane
- Epithelial Cells

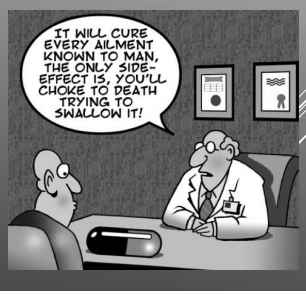
Charge/Size of protein inhibit proteins from going into urinary space



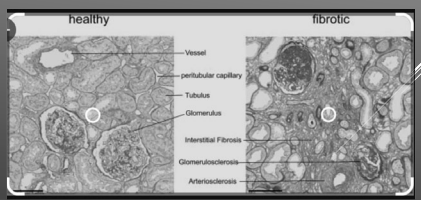

- What are the negative effects of Proteinuria?

# OUTLINE: PART 2




# PROTEINURIA AND DOWNSTREAM AFFECTS

- Glomerular permeability dysfunction of proteinuric nephropathies allows complement factors to be ultrafiltered abnormally across the altered glomerular barrier into the Bowman's space and tubular lumen.
- Complement activation is a powerful mechanism underlying tubular and interstitial injury *via* cytotoxic, proinflammatory, and fibrogenic effects.

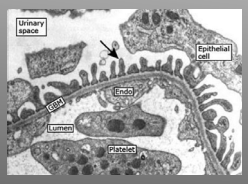


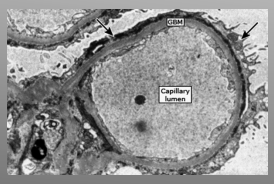

- Decreased antithrombin III
- Decreased plasminogen
- Decreased protein C and S
- Increased platelet activation
- Hyperfibrinogenemia

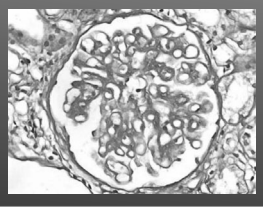
# HYPERCOAGULABLE

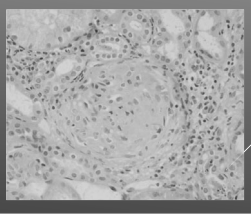
- Hypogammaglobulinemia due to protein loss
  - immunoglobulin G (IgG)
- Depressed cellular immunity due to loss of vitamin D and other serum factors

# INFECTION



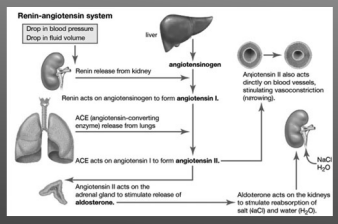





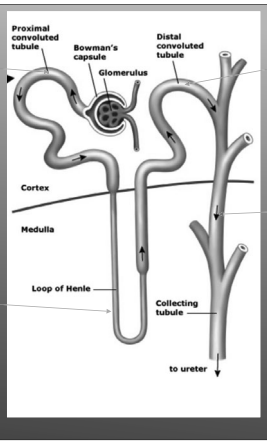
## Edema: Outline part 3

## EDEMA

- Sodium retention that is directly induced by the kidney disease
- Secondary sodium retention in which the low plasma oncotic pressure due to hypoalbuminemia promotes the movement of fluid from the vascular space into the interstitium, leading to underfilling of the vasculature
- Activation of the renin-angiotensin-aldosterone system




Carbonic anhydrase inhibitors SGLT2I




Thiazide Diuretics
MRA

Vaptans
MRA

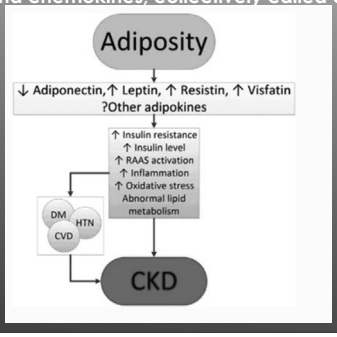
Loop Diuretics

- What are the some causes of Proteinuria?

## OUTLINE: PART 4


## Obesity Related Glomerulopathy

**Adipose tissue is a pleiotropic source of hormones and chemokines, collectively called adipokines**



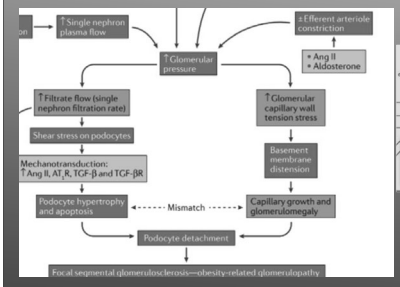

**Leptin** regulate energy balance and hunger .

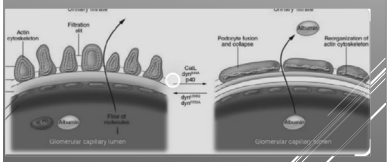
**Resistin** links obesity to insulin resistance and is pro inflammatory

**Visfatin** insulin receptor binder/pro fibrotic

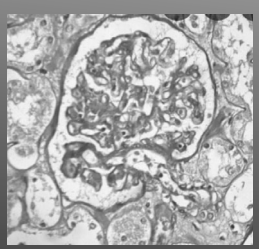
**Adiponectin** plays a crucial role in protecting against insulin resistance/diabetes and atherosclerosis.

A compensatory mechanism of hyperfiltration occurs to meet the heightened metabolic demands of the increased body weight.

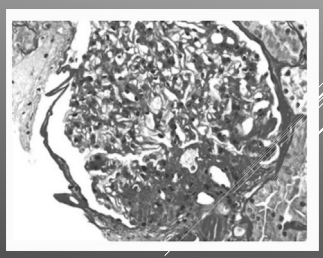



Normal



Obesity Affected



| Characteristic | ORG-related FSGS |
|---|---|
| Age at presentation | Most common in middle-aged adults (mean age 37–46 years[15–17,51,52]), but may be present in children and older adults |
| Clinical presentation | Slowly progressive proteinuria |
| Proteinuria and serum albumin | • Sub-nephrotic proteinuria in 52–90% of patients<br>• Normal serum albumin levels |
| Full nephrotic syndrome* | Unusual (<5% of patients) even in patients with massive proteinuria |
| Clinical course | • Slower progression than primary FSGS<br>• Renal survival 75% at 5 years and 50% at 10 years[16,17] |
| Glomeruli with FSGS lesions | Fewer than in primary FSGS (mean 12% of glomeruli[16]) |
| FSGS variants | Perihilar variant more common |
| Glomerulomegaly | Defining feature of ORG (100% of cases[16]) |
| Foot process effacement | Usually <50% glomerular surface area |

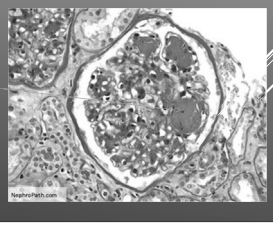

- Diabetes is the leading cause of chronic kidney disease (CKD) and end-stage kidney disease (ESKD) in the United States and worldwide.
- The proportion of people with diabetes who also have CKD has remained relatively stable (approximately 25 to 30 percent) over the past 20 years.
- Currently, more than 3 million people worldwide are estimated to be receiving treatment for kidney failure, with predictions that the number will increase to more than 5 million by 2035.

## DIABETES AND THE KIDNEY

## CASCADE OF CHAOS

- Hyperglycemia results in production of advanced glycation end-products (AGE)
- Reactive oxygen cytokines
- Metabolic products activate intercellular signaling for proinflammatory and profibrotic gene expressions

Kimmelstiel-Wilson Nodules



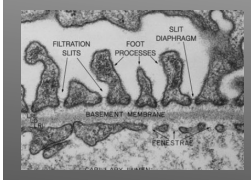

- Poor glycemic control
- Older age
- Non-white race
- Low socioeconomic status
- Obesity
- Smoking
- Blood pressure control
- Genetic factors

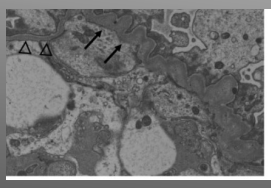
## RISK OF PROGRESSION

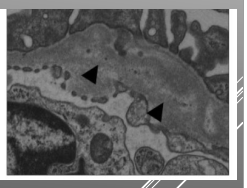
- Rapid decline in GFR (in a patient that has been stable)
- Sudden onset of nephrotic syndrome <5 years from diagnosis of DM
- Active urinary sediment
- Signs of systemic disease
- Lack of retinopathy/neuropathy
- People who have diabetes for more than 20 years without any previous evidence

## COULD IT BE SOMETHING ELSE BESIDES DM

- Leading cause of proteinuria after DM
- Thickened basement membrane





## MEMBRANOUS NEPHROPATHY

- Primary Membranous
  - PLA2R Antibodies
  - positive in 80% of primary
- Secondary membranous
  - Cancer (solid Tumors)
  - NSAIDS
  - Hepatitis

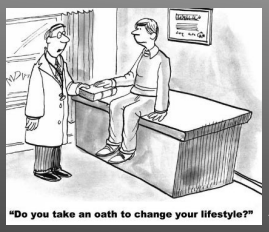
## MEMBRANOUS NEPHROPATHY

- Light chains do not show up on a traditional dipstick/UA with evidence of proteinuria
- Need specific testing if there is a index of suspicion
  - Kappa/ Lambda light Chains
  - SPEP/UPEP
  - Immunofixation

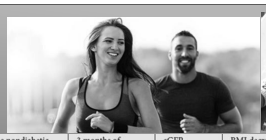
# LIGHT CHAIN DISEASE/ MYELOMA/ AMYLOID

- How can we control and improve proteinuria?

# OUTLINE: PART 5



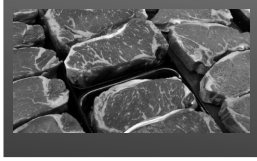

# WEIGHT LOSS

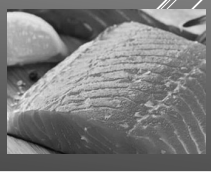


| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gilardini *et al.* [30] | 2010 | Prospective | 269 obese nondiabetic women (BMI 36.8 ± 4.6 kg/m$^2$), 17 with pathological albuminuria | 3 months of lifestyle intervention including periodic visits for education, advice reinforcement in dietary and exercise management. | eGFR Creatinine Albuminuria | BMI decreased in all subjects ($P < 0.05$). Creatinine and eGFR remained stable. 8 of 17 women with microalbuminuria became normoalbuminuric. | Waist circumference decreased in all subjects. Insulin sensitivity and glucose levels significantly decreased only are women with improvement in albuminuria. |
| Shen *et al.* [31] | 2010 | Prospective | 63 obese patients (BMI 30.83 ± 2.86 kg/m$^2$) with biopsy-proven obesity-related glomerulopathy (55.6% FSGS) and proteinuria (1.48 ± 0.87 g/24 h) | 24 months of 500 kCal-restriction diet + aerobic exercise 3 days/week | eGFR Proteinuria | At 6 months, 27 patients lost weight by 8.29 ± 4.00%, with a mean decrease in proteinuria of 35.3%, At 24 months later, 27 patients achieved a 9.20 ± 3.78% reduction in BMI and a 51.33% reduction in proteinuria (both $P < 0.0001$). In patients with increased BMI, proteinuria increased by 28.78%. | Weight loss improved also lipid profile, BP Changes in BMI were the only predictor of proteinuria ($P < 0.01$) |
| Ezequiel *et al.* [32] | 2012 | Prospective | 35 nondiabetic obese patients with metabolic syndrome, pathological albuminuria but conserved eGFR | 12 weeks of low calories diet | eGFR Albuminuria | In responders ($n = 14$), diet produced a significant reduction in albuminuria and eGFR (both $P < 0.001$). | Diet improved also lipid profile in responders. |

# LOW PROTEIN DIET

- High protein intake increases glomerular pressure and hyperfiltration that negatively affect kidney function and proteinuria
- Certain animal proteins, red meat and processed meat, increased inflammatory markers and oxidative stress
- Degree of protein restriction is variable among studies, ranging from 0.8 to 0.3 g/kg exact recommendation is unclear





## Low Protein Diet Studies

| Testing LPD vs NPD on Top of Baseline RAASi | | | |
|---|---|---|---|
| Di Iorio et al [61] (2013) | Observational cohort study; CKD3-5, proteinuria > 1 g/d; all patients using RAASi at inclusion and LPD (0.6 g/kg/d) or LPD + KA (0.3 kg/g/d) was added; f/u of 24 mo; N = 99 | 100% with RAASi | UUN-estimated protein intake at baseline: 0.95 g/kg/d; ↓ proteinuria (−48% in LPD + KA + RAASi, −20% in LPD + RAASi vs baseline [RAASi alone with NDP]); no change in GFR decline |
| Giordano et al [62] (2008) | Observational study; T2DM with severely increased albuminuria; all patients using ACEi at inclusion and NPD was added (1.2 g/kg/d) and later an LPD (0.8 g/kg/d); f/u of 4 wk for each diet; N = 9 | 100% with ACEi | UUN-estimated protein intake: 0.81 g/kg/d in LPD, 1.38 g/kg/d in NPD; ↓ proteinuria (−40% in LPD + RAASi vs RAASi alone with NDP); no difference in GFR |

Examples

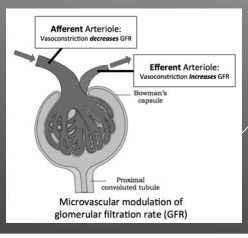
1 egg=6 grms
Salmon fillet 45 grm
Strip steak 55
Checken Breast 45

- ACE/ARB
- Mineral-Corticoid Receptor Antagonists
- SGLT2 Inhibitors
- Glucagon Like Peptide-1 Agonists
- Glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic peptide (GIP) receptor agonist

# MEDICATIONS

# ACE/ARB

- The Effect of Angiotensin-Converting-Enzyme Inhibition on Diabetic Nephropathy **NEJM 1993**
- Effects of Losartan on Renal and Cardiovascular Outcomes in Patients with Type 2 Diabetes and Nephropathy NEJM 2001

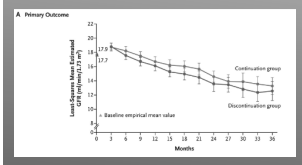


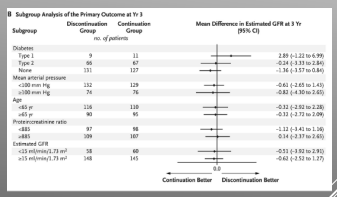
Microvascular modulation of glomerular filtration rate (GFR)

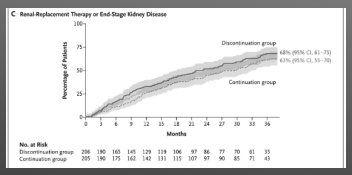
## RENIN–ANGIOTENSIN SYSTEM INHIBITION IN ADVANCED CHRONIC KIDNEY DISEASE,NEJM 12/22

| | RAS Inhibitor Discontinuation Group (N=206) | RAS Inhibitor Continuation Group (N=205) |
|---|---|---|
| Estimated glomerular filtration rate | | |
| Median (IQR) — ml/min/1.73 m$^2$ | 18 (14 to 22) | 18 (14 to 21) |
| Distribution — no. (%) | | |
| <15 ml/min/1.73 m$^2$ | 58 (28) | 60 (29) |
| ≥15 ml/min/1.73 m$^2$ | 148 (72) | 145 (71) |
| Median rate of decrease over 24 mo (IQR) — ml/min/yr | −4.8 (−7.6 to −3.3) | −4.7 (−7.3 to −3.5) |
| Protein:creatinine ratio§ | | |
| Median (IQR) | 960 (230 to 2089) | 1035 (265 to 2230) |
| Distribution — no. of patients (%) | | |
| <885 | 97 (47) | 98 (48) |
| ≥885 | 109 (53) | 107 (52) |

## Results




**Serious Adverse Events**

| Variable | Discontinuation Group | Continuation Group |
|---|---|---|
| Patients — no./total no. (%) | 107/206 (52) | 101/205 (49) |
| No. of events | 237 | 253 |
| No. of cardiovascular events | 108 | 88 |

- The activation of the RAAS pathway leads to the production of aldosterone.
- Aldosterone is a mineralocorticoid hormone produced by the adrenal cortex.
  - Reabsorption of sodium and secretion of potassium.
- The mineralocorticoid receptor is present in the distal tubule/collecting of the kidney and also within glomeruli on podocytes and mesangial cells.
- Mineralocorticoid receptor also functions as a transcription factor that can increase the levels of inflammatory cytokines
  - increasing local levels of reactive oxygen species
  - profibrotic factors

# ALDOSTERONE

Long term effects of spironolactone on proteinuria and kidney function in patients with chronic kidney disease
Kidney International

| | All | Conventional therapy | Conventional therapy plus spironolactone |
|---|---|---|---|
| No. of patients | 165 | 82 | 83 |
| eGFR (ml/min/1.73 $m^2$) | 62.3±1.6 | 62.2±2.1 | 62.4±2.4 |
| Uprotein (g/g creatinine) | 2.1±0.05 | 2.0±0.07 | 2.1±0.08 |

| | Conventional | Conventional/ Spironlactone |
|---|---|---|
| *9 months all* | 2.0±0.07 | 0.99±0.06 (−49.9%)* |
| eGFR<60 ml/min | 2.1±0.08 | 1.0±0.08 (−56.4%) |
| eGFR>60 ml/min | 1.94±0.07 | 0.98±0.08 (−40.%)** |
| *12 months all* | 2.11±0.08 | 0.89±0.06 (−54.2%)* |
| eGFR<60 ml/min | 2.19±0.09 | 0.88±0.09 (−62.2%) |
| eGFR>60 ml/min | 1.99±0.08 | 0.93±0.09 (−42.9%)** |

## EFFECT OF FINERENONE ON CHRONIC KIDNEY DISEASE OUTCOMES IN TYPE 2 DIABETES, NEJM 2020;383:2219-2229

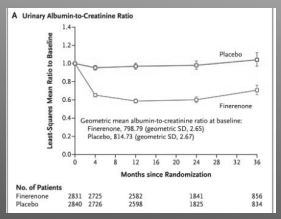
- Primary composite outcome
  - Kidney failure
  - Sustained decrease of at least 40% in the eGFR from baseline
  - Death from renal causes.
- Secondary composite outcome
  - Death from cardiovascular causes
  - Nonfatal myocardial infarction
  - Nonfatal stroke
  - Hospitalization for heart failure

| Characteristic | Finerenone (N=2833) | Placebo (N=2841) | Total (N=5674) |
|---|---|---|---|
| ≥60 ml/min/1.73 $m^2$ | 318 (11.2) | 338 (11.9) | 656 (11.6) |
| 45 to <60 ml/min/1.73 $m^2$ | 972 (34.3) | 928 (32.7) | 1900 (33.5) |
| 25 to <45 ml/min/1.73 $m^2$ | 1476 (52.1) | 1505 (53.0) | 2981 (52.5) |
| <25 ml/min/1.73 $m^2$ | 66 (2.3) | 69 (2.4) | 135 (2.4) |
| Missing data | 1 (<0.1) | 1 (<0.1) | 2 (<0.1) |
| Urinary albumin-to-creatinine ratio‡ | | | |
| Median (IQR) | 833 (441–1628) | 867 (453–1645) | 852 (446–1634) |
| Distribution — no. (%) | | | |
| <30 | 11 (0.4) | 12 (0.4) | 23 (0.4) |
| 30 to <300 | 350 (12.4) | 335 (11.8) | 685 (12.1) |
| ≥300 | 2470 (87.2) | 2493 (87.8) | 4963 (87.5) |
| Missing data | 2 (<0.1) | 1 (<0.1) | 3 (<0.1) |

| Outcome | Finerenone (N=2833) | Placebo (N=2841) | Finerenone (N=2833) | Placebo (N=2841) | Hazard Ratio (95% CI) | P Value |
|---|---|---|---|---|---|---|
| | *no. of patients with event (%)* | | *no. of patients with event per 100 patient-yr* | | | |
| Primary composite outcome | 504 (17.8) | 600 (21.1) | 7.59 | 9.08 | 0.82 (0.73–0.93) | 0.001 |
| Kidney failure | 208 (7.3) | 235 (8.3) | 2.99 | 3.39 | 0.87 (0.72–1.05) | — |
| End-stage kidney disease | 119 (4.2) | 139 (4.9) | 1.60 | 1.87 | 0.86 (0.67–1.10) | — |
| Sustained decrease in eGFR to <15 ml/min/1.73 $m^2$ | 167 (5.9) | 199 (7.0) | 2.40 | 2.87 | 0.82 (0.67–1.01) | — |
| Sustained decrease of ≥40% in eGFR from baseline | 479 (16.9) | 577 (20.3) | 7.21 | 8.73 | 0.81 (0.72–0.92) | — |
| Death from renal causes | 2 (<0.1) | 2 (<0.1) | — | — | — | — |
| Key secondary composite outcome | 367 (13.0) | 420 (14.8) | 5.11 | 5.92 | 0.86 (0.75–0.99) | 0.03 |
| Death from cardiovascular causes | 128 (4.5) | 150 (5.3) | 1.69 | 1.99 | 0.86 (0.68–1.08) | — |
| Nonfatal myocardial infarction | 70 (2.5) | 87 (3.1) | 0.94 | 1.17 | 0.80 (0.58–1.09) | — |
| Nonfatal stroke | 90 (3.2) | 87 (3.1) | 1.21 | 1.18 | 1.03 (0.76–1.38) | — |
| Hospitalization for heart failure | 139 (4.9) | 162 (5.7) | 1.89 | 2.21 | 0.86 (0.68–1.08) | — |
| Death from any cause | 219 (7.7) | 244 (8.6) | 2.90 | 3.23 | 0.90 (0.75–1.07) | — |
| Hospitalization for any cause | 1263 (44.6) | 1321 (46.5) | 22.56 | 23.87 | 0.95 (0.88–1.02) | — |
| Secondary composite kidney outcome | 252 (8.9) | 326 (11.5) | 3.64 | 4.74 | 0.76 (0.65–0.90) | — |
| Sustained decrease of ≥57% in eGFR from baseline | 167 (5.9) | 245 (8.6) | 2.41 | 3.54 | 0.68 (0.55–0.82) | — |



## Results in regards to proteinuria



- Activates macula densa restores the tubuloglomerular feedback by promoting afferent arteriole vasoconstriction, thus decreasing intraglomerular pressure and GFR
- SGLT-2 inhibitors have anti-inflammatory, anti-fibrotic and antioxidant effects, as they are able to suppress advanced glycation end products (AGEs)

# SGLT2 INHIBITORS

## DAPAGLIFLOZIN IN PATIENTS WITH CHRONIC KIDNEY DISEASE N ENGL J MED 2020; 383:1436-1446

- Primary outcome
- Sustained decline in the estimated GFR of at least 50%
- End-stage kidney disease
- Death from renal or cardiovascular causes.

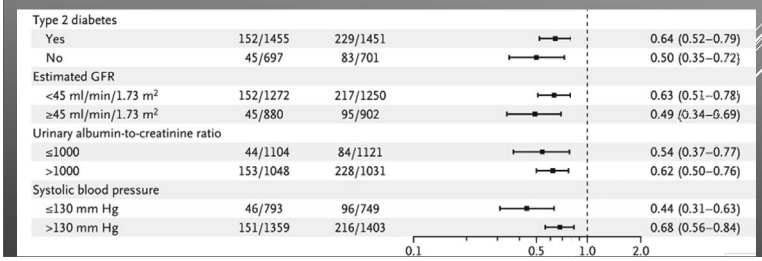
Table 1. **Demographic and Clinical Characteristics of the Participants at Baseline.***

| Characteristic | Dapagliflozin (N=2152) | Placebo (N=2152) |
|---|---|---|
| Estimated GFR | | |
| Mean — ml/min/1.73 m² | 43.2±12.3 | 43.0±12.4 |
| Distribution — no. (%) | | |
| ≥60 ml/min/1.73 m² | 234 (10.9) | 220 (10.2) |
| 45 to <60 ml/min/1.73 m² | 646 (30.0) | 682 (31.7) |
| 30 to <45 ml/min/1.73 m² | 979 (45.5) | 919 (42.7) |
| <30 ml/min/1.73 m² | 293 (13.6) | 331 (15.4) |
| Urinary albumin-to-creatinine ratio§ | | |
| Median (interquartile range) | 965 (472–1903) | 934 (482–1868) |
| >1000 — no. (%) | 1048 (48.7) | 1031 (47.9) |
| Type 2 diabetes — no. (%) | 1455 (67.6) | 1451 (67.4) |

Table 2. **Primary and Secondary Outcomes and Adverse Events of Special Interest.***

| Outcome | Dapagliflozin | | Placebo | | Hazard Ratio (95% CI) | P Value |
|---|---|---|---|---|---|---|
| | *no./total no. (%)* | *events/100 patient-yr* | *no./total no. (%)* | *events/100 patient-yr* | | |
| **Primary outcome** | | | | | | |
| Primary composite outcome | 197/2152 (9.2) | 4.6 | 312/2152 (14.5) | 7.5 | 0.61 (0.51–0.72) | <0.001 |
| Decline in estimated GFR of ≥50% | 112/2152 (5.2) | 2.6 | 201/2152 (9.3) | 4.8 | 0.53 (0.42–0.67) | NA |
| End-stage kidney disease | 109/2152 (5.1) | 2.5 | 161/2152 (7.5) | 3.8 | 0.64 (0.50–0.82) | NA |
| Estimated GFR of <15 ml/min/1.73 m² | 84/2152 (3.9) | 1.9 | 120/2152 (5.6) | 2.8 | 0.67 (0.51–0.88) | NA |
| Long-term dialysis† | 68/2152 (3.2) | 1.5 | 99/2152 (4.6) | 2.2 | 0.66 (0.48–0.90) | NA |
| Kidney transplantation† | 3/2152 (0.1) | 0.1 | 8/2152 (0.4) | 0.2 | — | NA |
| Death from renal causes | 2/2152 (<0.1) | 0.0 | 6/2152 (0.3) | 0.1 | — | NA |
| Death from cardiovascular causes | 65/2152 (3.0) | 1.4 | 80/2152 (3.7) | 1.7 | 0.81 (0.58–1.12) | NA |

| Secondary outcomes | | | | | | |
|---|---|---|---|---|---|---|
| Composite of decline in estimated GFR of ≥50%, end-stage kidney disease, or death from renal causes | 142/2152 (6.6) | 3.3 | 243/2152 (11.3) | 5.8 | 0.56 (0.45–0.68) | <0.001 |
| Composite of death from cardiovascular causes or hospitalization for heart failure | 100/2152 (4.6) | 2.2 | 138/2152 (6.4) | 3.0 | 0.71 (0.55–0.92) | 0.009 |
| Death from any cause | 101/2152 (4.7) | 2.2 | 146/2152 (6.8) | 3.1 | 0.69 (0.53–0.88) | 0.004 |




ORIGINAL ARTICLE

## Empagliflozin in Patients with Chronic Kidney Disease

The EMPA-KIDNEY Collaborative Group*

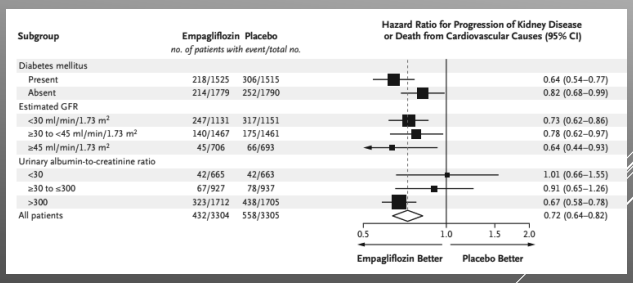
January 12, 2023
N Engl J Med 2023; 388:117-127
DOI: 10.1056/NEJMoa2204233

- The primary outcome
- Progression of kidney disease
  - End-stage kidney disease
  - Sustained decrease in eGFR to <10 ml per minute per 1.73 m²
  - Sustained decrease in eGFR of ≥40% from baseline
  - Death from renal causes
- Death from cardiovascular causes.

Table 1. **Characteristics of the Patients at Baseline.***

| Characteristic | Empagliflozin (N=3304) | Placebo (N=3305) |
|---|---|---|
| History of diabetes — no. (%)‡ | | |
| Yes | 1525 (46.2) | 1515 (45.8) |
| No | 1779 (53.8) | 1790 (54.2) |
| Estimated GFR‖ | | |
| Mean — ml/min/1.73 m² | 37.4±14.5 | 37.3±14.4 |
| Distribution — no. (%) | | |
| <30 ml/min/1.73 m² | 1131 (34.2) | 1151 (34.8) |
| ≥30 to <45 ml/min/1.73 m² | 1467 (44.4) | 1461 (44.2) |
| ≥45 ml/min/1.73 m² | 706 (21.4) | 693 (21.0) |
| Urinary albumin-to-creatinine ratio¶** | | |
| Geometric mean (95% CI) | 219 (205–234) | 226 (211–242) |
| Median (IQR) | 331 (46–1061) | 327 (54–1074) |
| Distribution — no. (%) | | |
| <30 | 665 (20.1) | 663 (20.1) |
| ≥30 to ≤300 | 927 (28.1) | 937 (28.4) |
| >300 | 1712 (51.8) | 1705 (51.6) |
| Cause of kidney disease — no. (%) | | |
| Diabetic kidney disease | 1032 (31.2) | 1025 (31.0) |
| Hypertensive or renovascular disease | 706 (21.4) | 739 (22.4) |
| Glomerular disease | 853 (25.8) | 816 (24.7) |
| Other | 387 (11.7) | 421 (12.7) |
| Unknown | 326 (9.9) | 304 (9.2) |

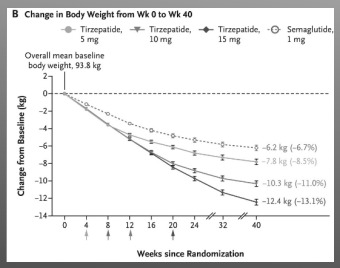
Results

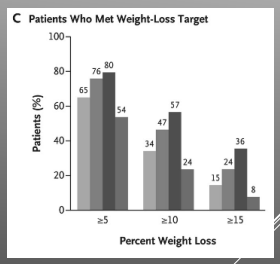


## TIRZEPATIDE VERSUS SEMAGLUTIDE ONCE WEEKLY IN PATIENTS WITH TYPE 2 DIABETES AUGUST 5, 2021
## N ENGL J MED

Table 1. **Demographic and Clinical Characteristics of the Patients at Baseline in the Modified Intention-to-Treat Population.***

| Characteristic | Tirzepatide | | | Semaglutide | Total (N=1878) |
|---|---|---|---|---|---|
| | 5 mg (N=470) | 10 mg (N=469) | 15 mg (N=470) | 1 mg (N=469) | |
| BMI‡ | 33.8±6.85 | 34.3±6.60 | 34.5±7.11 | 34.2±7.15 | 34.2±6.93 |
| Weight — kg | 92.5±21.76 | 94.8±22.71 | 93.8±21.83 | 93.7±21.12 | 93.7±21.86 |
| Waist circumference — cm | 108.06±14.81 | 110.55±16.05 | 109.55±15.60 | 109.04±14.90 | 109.30±15.36 |
| Estimated GFR§ | | | | | |
| Mean value — ml/min/1.73 $m^2$ | 96.6±17.51 | 95.5±16.62 | 96.3±16.92 | 95.6±17.25 | 96.0±17.07 |
| Value <60 ml/min/1.73 $m^2$ — no. (%) | 19 (4.0) | 15 (3.2) | 11 (2.3) | 19 (4.1) | 64 (3.4) |
| Value ≥60 ml/min/1.73 $m^2$ — no. (%) | 451 (96.0) | 454 (96.8) | 459 (97.7) | 450 (95.9) | 1814 (96.6) |
| Urinary albumin-to-creatinine ratio — no. (%)¶ | | | | | |
| <30 | 340 (72.3) | 353 (75.3) | 357 (76.0) | 364 (77.6) | 1414 (75.3) |
| 30 to ≤300 | 111 (23.6) | 87 (18.6) | 85 (18.1) | 90 (19.2) | 373 (19.9) |
| >300 | 18 (3.8) | 29 (6.2) | 27 (5.7) | 15 (3.2) | 89 (4.7) |




- Be aggressive with lifestyle
- Supplement with medications
  - Cost is often an issue
- Don't give up

## CONCLUSIONS

JB Received a transplant 1/14/23