



# Current Management of Patients With Acquired Solitary Kidney

Dr. Firouzeh Moeinzadeh  
Assistant professor of Nephrology  
Isfahan University of Medical Sciences

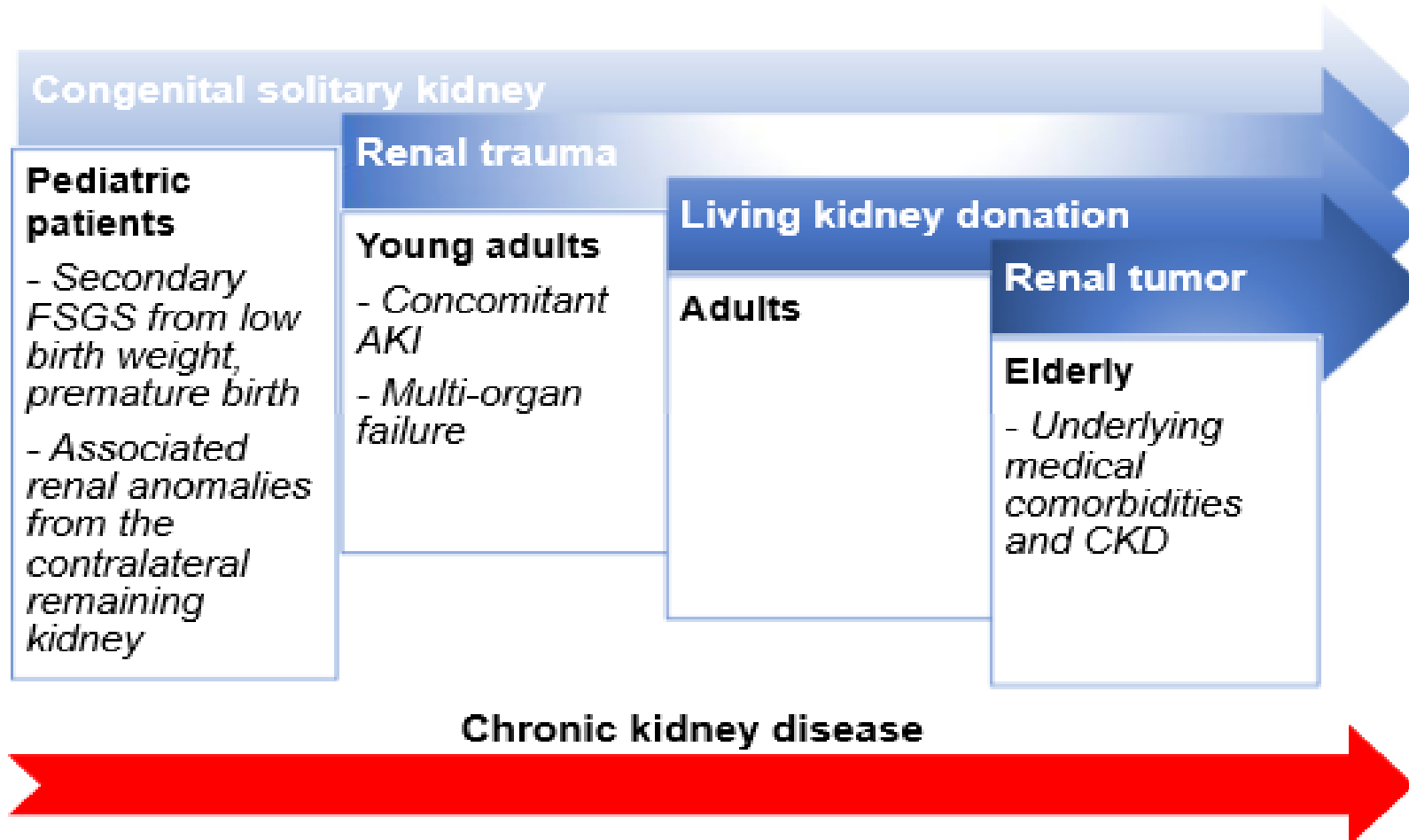
# Outlines

- Introduction to etiology of solitary kidney
- Donation and CKD risk
- Care for Persons with a Solitary Kidney: non-pharmacologic and pharmacologic intervention.
- Evaluation and Follow-up for Renal Function in Solitary Kidney

## **Current Management of Patients With Acquired Solitary Kidney**

Ekamol Tantisattamo<sup>1,2,3</sup>, Donald C. Dafoe<sup>4</sup>, Uttam G. Reddy<sup>1,2</sup>, Hirohito Ichii<sup>4</sup>,  
Connie M. Rhee<sup>1,2</sup>, Elani Streja<sup>1,2</sup>, Jaime Landman<sup>5</sup> and Kamyar Kalantar-Zadeh<sup>1,2,6</sup>

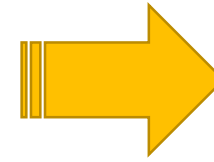
# Etiologies of solitary kidney across age groups and factors determining long-term renal function



- Living kidney donation

1800

1998



6600

2004

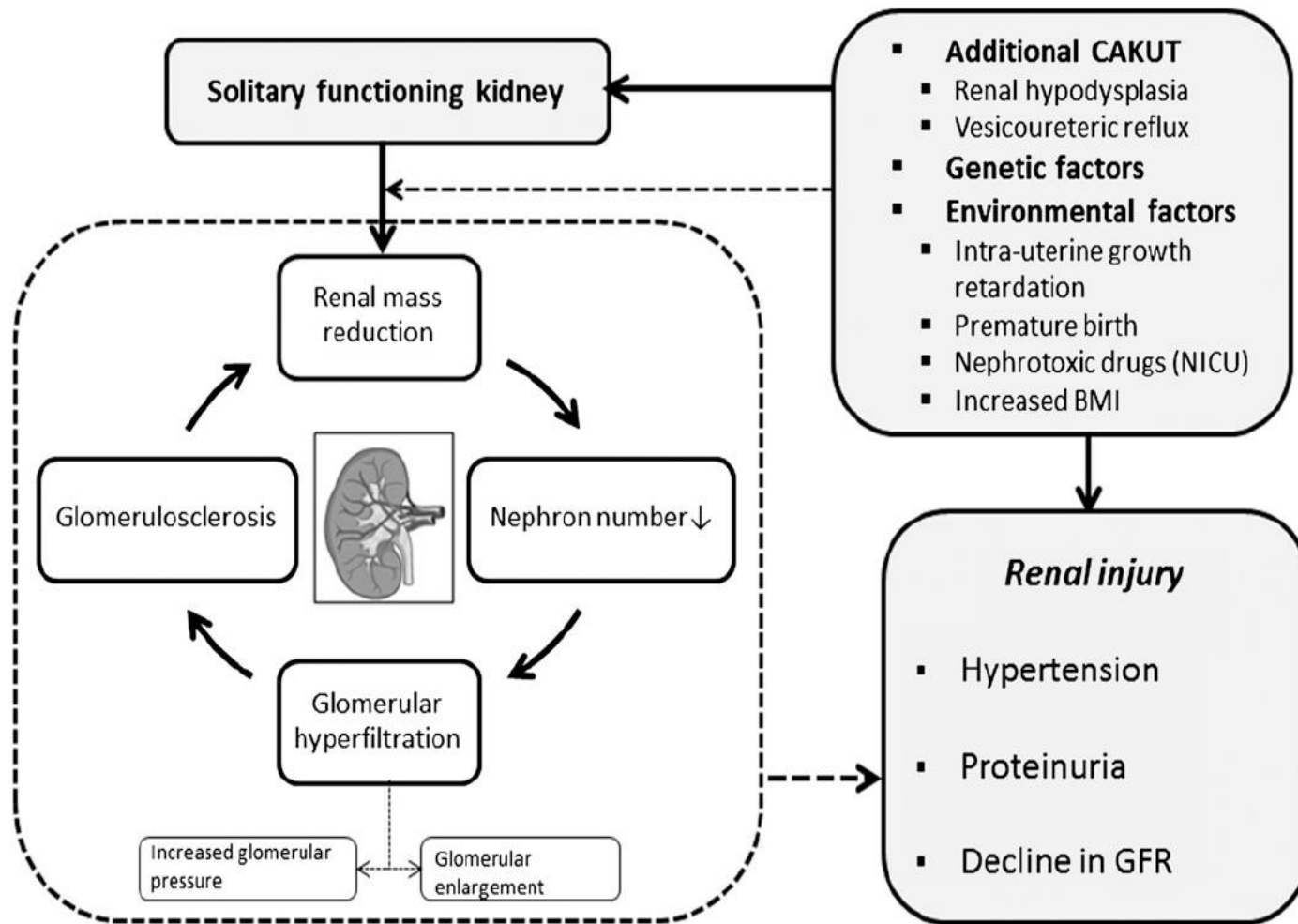


5650

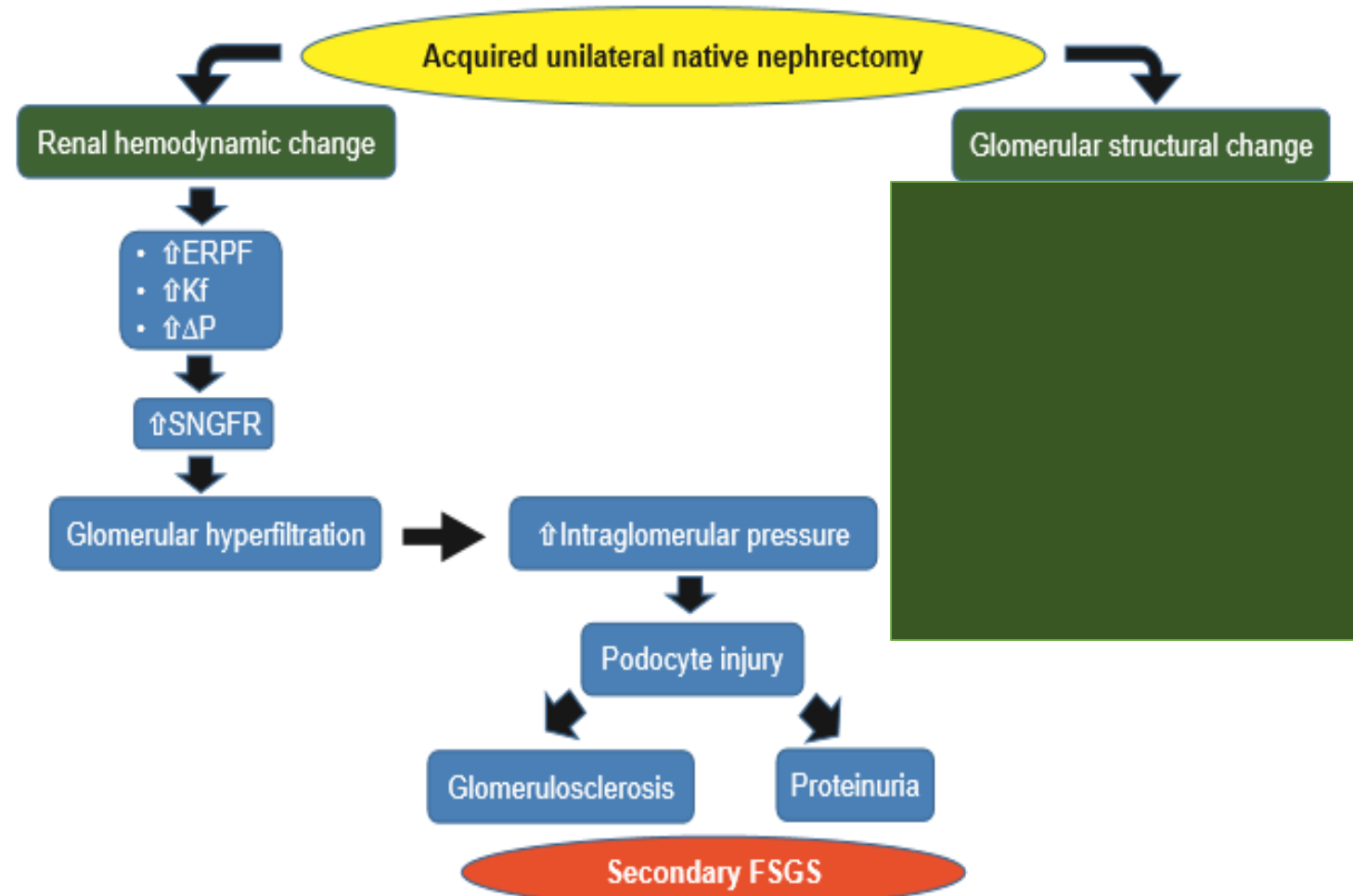
2011  
to....

- Renal tumor

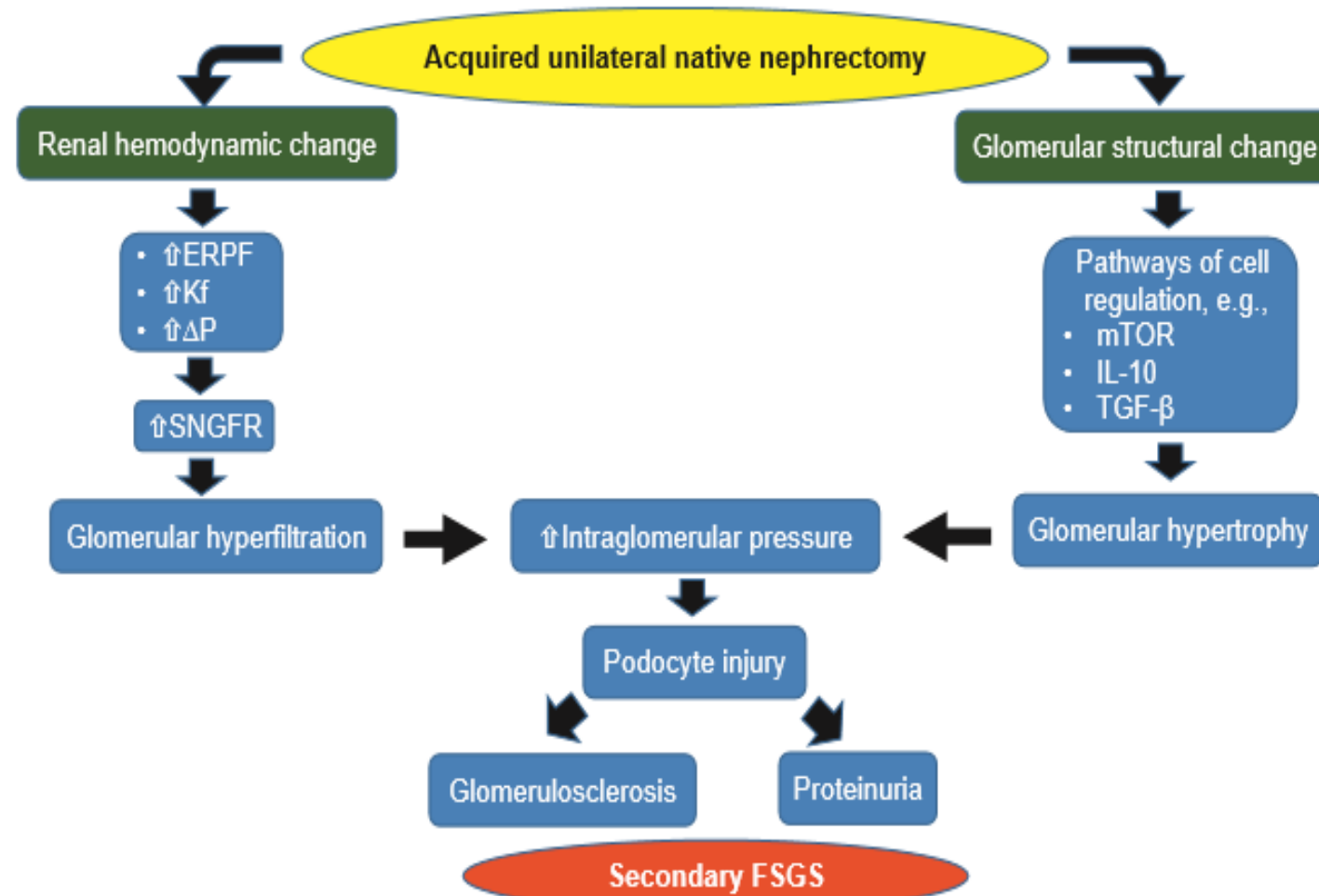
- Trauma



# Pathophysiological changes after unilateral native nephrectomy



# Pathophysiological changes after unilateral native nephrectomy



- The severity of progressive renal dysfunction and long-term renal outcomes are determined by the remaining nephron masses immediately after donation.



# DOES DONATING A KIDNEY LEAD TO CHRONIC KIDNEY DISEASE?



There is a 3–5 times higher relative risk of ESRD after a unilateral nephrectomy, while the absolute risk remains small

# DOES DONATING A KIDNEY LEAD TO CHRONIC KIDNEY DISEASE?

- Donors generally fare well after nephrectomy, with most studies showing no increase in long-term mortality and a lifetime risk of end-stage renal disease <1%.
- Although most donors end up with a clearance of approximately 65%- 70% of the original predonation GFR, some donors will be found to have an estimated eGFR <60 mL/min/1.73 m<sup>2</sup>

# DOES DONATING A KIDNEY LEAD TO CHRONIC KIDNEY DISEASE?

- Glomerulonephritis appears to be the most common renal disease, leading to early ESRD in living kidney donors, and underlying genetic predispositions may contribute to faster progression of CKD to ESRD in some groups of living kidney donors

Anjum S, Muzaale AD, Massie AB, et al. Patterns of end-stage renal disease caused by diabetes, hypertension, and glomerulonephritis in live kidney donors. *Am J Transplant*. 2016;16:3540-3547.

# DOES DONATING A KIDNEY LEAD TO CHRONIC KIDNEY DISEASE?

- Albuminuria appears to be a more important predictor of progression of chronic kidney disease, but it is rare for a donor to have significant albuminuria.
- Although donors have a stable GFR over time, they do exhibit some biochemical markers seen in chronic kidney disease such as small elevations in parathyroid hormone and uric acid.
- Postdonation proteinuria is generally mild, averaging 154 mg/day, and when proteinuria is present there is usually no significant albuminuria

- Postdonation increase in systolic blood pressure of 0-6 mm/Hg over time, consistent with normal aging.
- Target blood pressures should be <140/90 mm Hg, as in the general population without other risk factors

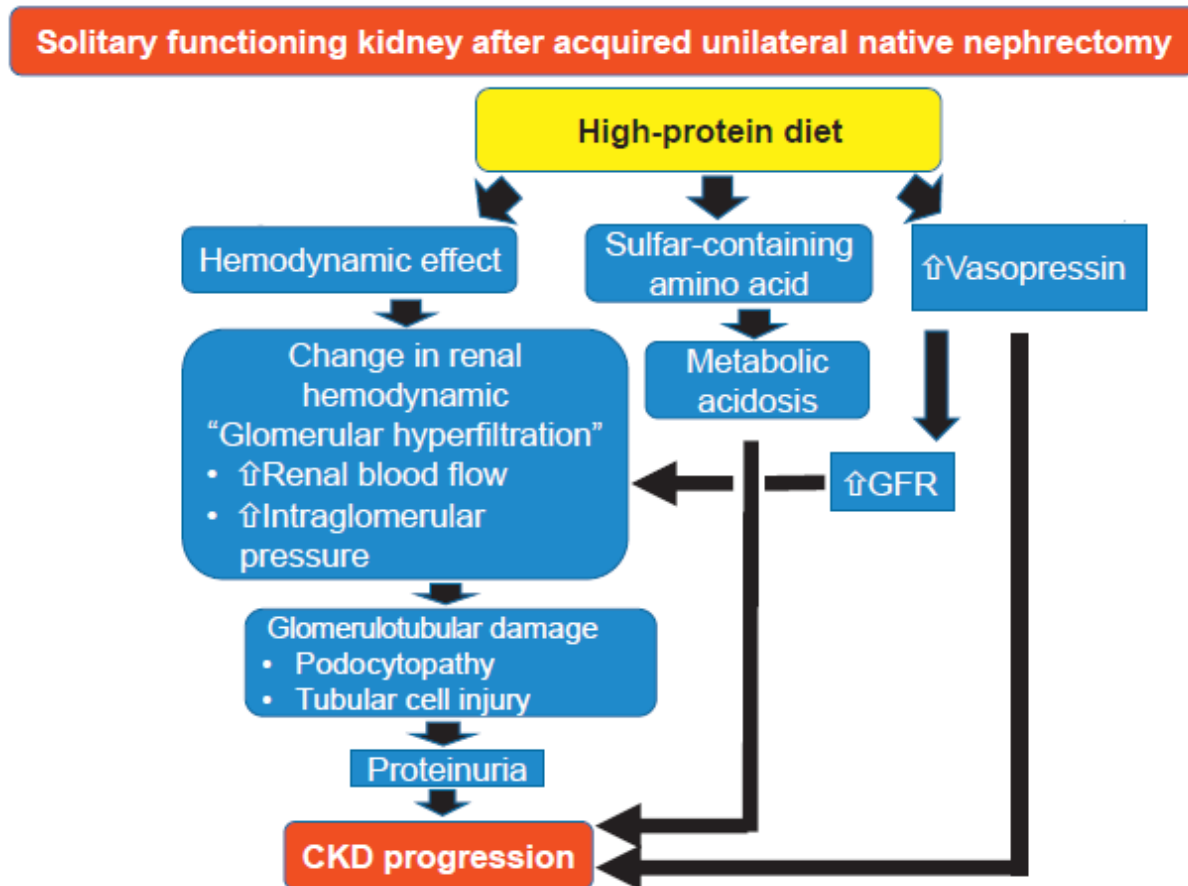
# eGFR AND MEDICATION ADJUSTMENT

- While most medications do not need adjustment when GFR is above 60 mL/min/1.73 m<sup>2</sup>
- An eGFR below 60 mL/min/1.73 m<sup>2</sup> and may require adjustments of several classes of drugs, including antibiotics, antihypertensives, antidiabetics, and chemotherapeutic agents.
- Choosing acetaminophen as a first-choice analgesic rather than a nonsteroidal anti-inflammatory drug is prudent, although no data demonstrate that patients with a solitary kidney are more susceptible to nonsteroidal anti-inflammatory drug nephropathies than the general population.

# Care for Persons with a Solitary Kidney

- Nonpharmacologic Interventions
  - Low protein diet
  - Low salt
  - Weight control
  - Adequate hydration
  - Physical activity

# Low-Protein Diet





# Low-Protein Diet

- A population-based study involving 1522 middle-age persons with a mean eGFR of  $84.0 \pm 11.4$  ml/min per  $1.73 \text{ m}^2$  showed a positive cross-sectional correlation between protein intake and GFR, but after a mean follow-up of 12 years, every 1 g/d increase in protein intake was associated with a 4.1 ml/min per  $1.73 \text{ m}^2$  decline in eGFR (95% confidence interval 5.1, 3.1) and a 78% higher risk for incidence of CKD defined as eGFR  $<60$  ml/min per  $1.73 \text{ m}^2$  (95% confidence interval).

# plant-based proteins over an animal-based diet?

- Participants with the highest red and processed meat consumption had an increased risk for incident CKD, while individuals with high consumption of nuts, low-fat dairy products or legumes were at a lower risk for CKD.
- Replacing red and processed meat in the diet with other sources of dietary protein, including nuts, low-fat dairy products and legumes was associated with lower CKD risk.

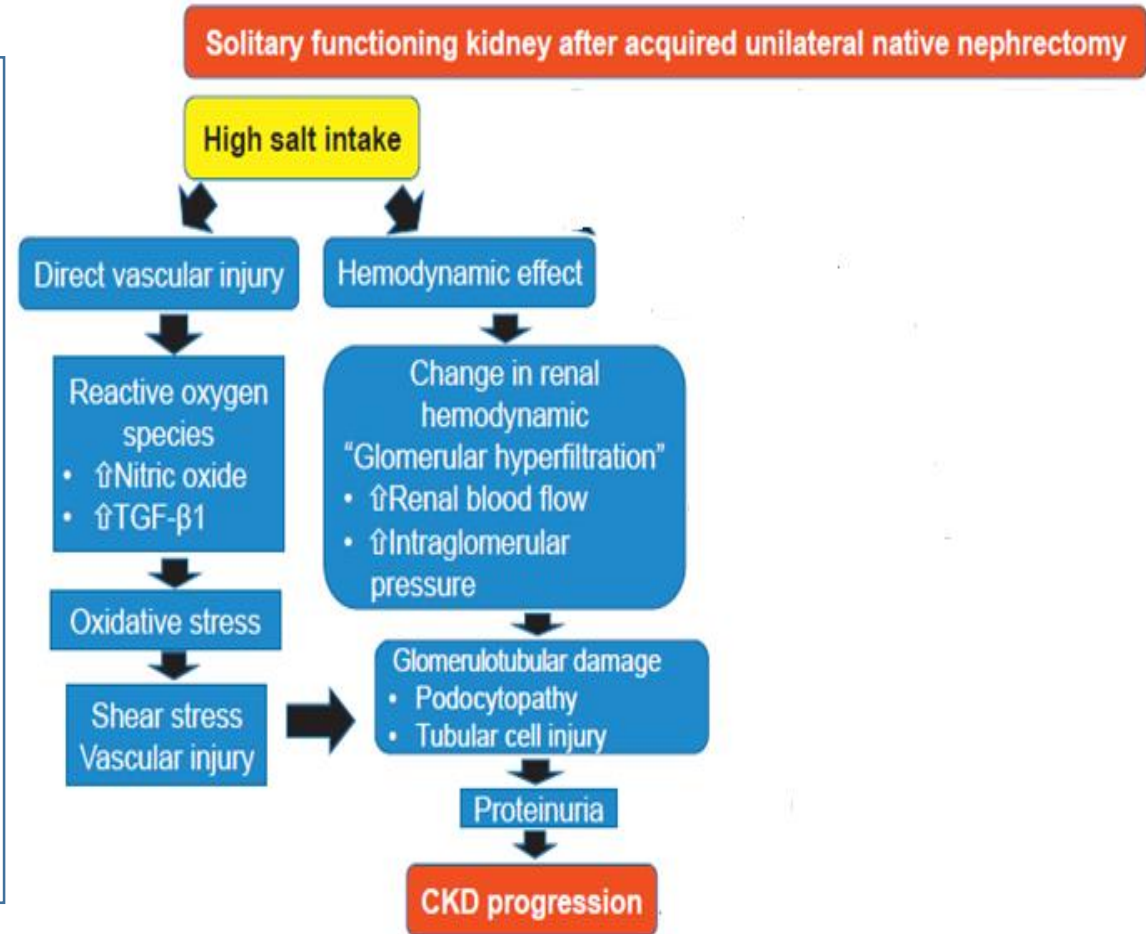
Haring B, Selvin E, Liang M, et al. Dietary protein sources and risk for incident chronic kidney disease: results from the Atherosclerosis Risk in Communities (ARIC) Study. *J Ren Nutr.* 2017;27:233–242.

# A preferred diet for persons with solitary kidney

- Diet type: DASH diet (Dietary Approaches to Stop Hypertension)
- Features: Mix of fruits, vegetables, whole grains, lean protein, and low-fat dairy
- It is often recommended that patients with hypertension follow an energy-controlled DASH diet, which is high in complex carbohydrates including fruits, vegetables, and whole grains, as well as legumes, and low in animal-based protein such as meat, saturated fat, refined grains, sweets, and processed food.

# Low Dietary Sodium Intake

- A recent meta-analysis demonstrated no preventive benefit for CKD progression from reducing sodium intake in the long term
- One longitudinal study using serial 24 h urine collections in 3939 CKD patients suggested that the highest versus lowest quartile of urinary sodium excretion (4.5 vs. <2.7 g/d) was associated with 45% higher mortality and 54% greater risk of disease progression



# Low Dietary Sodium Intake

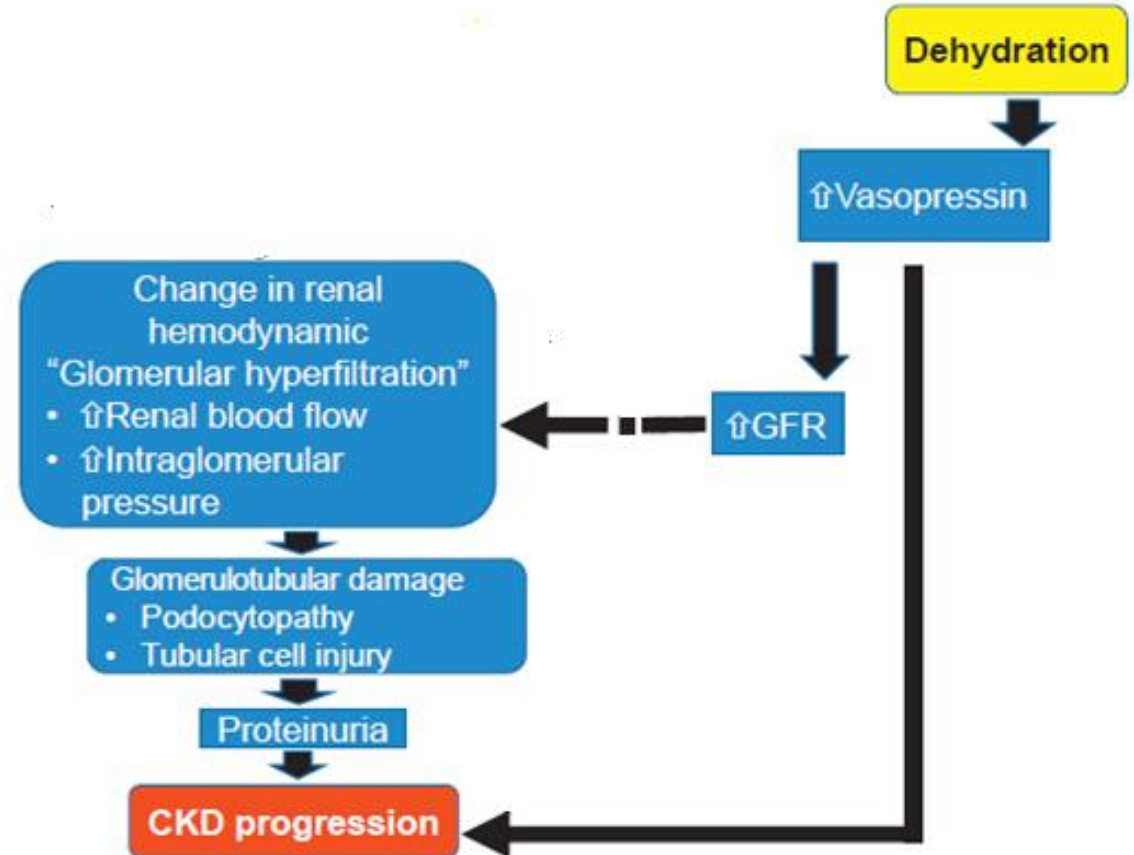
- A recent observations in the general population suggest that there is a J-shaped association in which both higher and lower dietary sodium intake ( $>5$  and  $<3$  g/d) were associated with higher risk of CVD and death.
- Recommendation: avoiding a diet with  $>4$  g/d of sodium in individuals at higher risk of developing future CKD, including those with a solitary kidney

# Weight Control

- Obese donors had a 1.86 times higher risk of ESRD over 20 years following nephrectomy compared to nonobese donors, and overweight donors exhibited incrementally a 7% higher risk of ESRD for every 1 kg/m<sup>2</sup> higher body mass index above 27 kg/m<sup>2</sup>.
- Recommendation: a target body mass index of <30 kg/m<sup>2</sup> in non-athletes and non-bodybuilders with a solitary kidney

# Adequate Hydration

**Recommendation:**  
Adequate to generous fluid intake (>2.5 L/day) in persons with a solitary kidney and eGFR >60 ml/min per 1.73 m<sup>2</sup>, as long as there is no material risk of hyponatremia.



# Smoking Cessation

- Smokers have 76% higher 15-year projections of ESRD risk in the absence of kidney donation compared with nonsmokers.
- The risk is attenuated but still as high as 45% in former smokers.
- Living kidney donors who smoked do not appear to have increased surgical mortality risk compared with nonsmokers; however, they had 5.3 times greater adjusted mortality risk over 4 years.
- Persons with solitary kidney should be advised routinely to avoid smoking.



# Physical Activity After Nephrectomy

- Evidence showed that exercise improves some side effects for cancer, quality of life, and survival, via alteration in neuro-hormones, cell growth regulatory pathway, gene expression, and tumor immunity.
- For living kidney donors, physical activity improves not only their health and weight control, but also their mental health

# Pharmacologic Interventions

- Blood Pressure Control:
- An increased night-to-day systolic BP ratio, and a decreased dipper pattern in CKD patients before, compared with after, a unilateral nephrectomy have been reported in patients with renal and/or ureteral cancer.
- In living kidney donors, BP does not appear to be elevated in the short term, and similar data are reported in long-term follow-up studies (up to 5 years) and even in donors with pre-donation hypertension

# Blood Pressure Control

- A target BP of  $<130/80$  mm Hg, and a BP threshold to initiate antihypertensive therapy of  $\geq 140/90$  mm Hg, are recommended for patients with no clinical CVD and a 10- year atherosclerotic cardiovascular disease risk of  $<10\%$
- For patients with the latter risk of  $\geq 10\%$ , antihypertensive medications should be initiated when BP  $\geq 130/80$  mm Hg

# Proteinuria Management in Solitary Kidney

- Angiotensin pathway modulators including ACEIs and ARBs are often used to improve proteinuria and slow progression of renal disease.

# Antiplatelet Agents

- Evidence suggests that aspirin lowers cardiovascular events in CKD and it may also delay CKD progression.
- Currently have no recommendation for or against intake of aspirin or other antiplatelet agents in persons with an acquired solitary kidney.

Ravinder K. Wali ,[Aspirin and the Prevention of Cardiovascular Disease in Chronic Kidney Disease](#). Journal of the American College of Cardiology, Volume 56, Issue 12, 14 September 2010, Pages 966-968



# Evaluation and Follow-up for Renal Function in Solitary Kidney

# Evaluation and Follow-up for Renal Function in Solitary Kidney

- Several studies have demonstrated that creatinine-based eGFR inaccurately estimates GFR in patients with a solitary kidney, including pediatric and adult populations with congenital renal diseases or after nephrectomy due to acquired renal diseases, as well as adult living kidney donors.
- A 24-hour urine test for creatinine clearance is a classic approach; however, it is inconvenient and can overestimate the true GFR due to renal tubular creatinine secretion

# Albuminuria Measurement

- The 2017 Kidney Disease Improving Global Outcomes guidelines recommend checking assessment and monitoring of albuminuria in living kidney donors at least once a year for early detection of proteinuria



# Take home message

- Persons with a normal functioning solitary kidney are likely at higher risk of developing CKD and of progression to ESRD.
- Recommendations pertaining to lifestyle modifications and nutrition for patients who have undergone or will undergo nephrectomy are warranted to achieve the goal of maintaining longevity and health similar to that in the general population.

