

# Hemodialysis and Cardiovascular Disease

By: Samantha Hollister, Dietetic Intern

# The Patient: JL

## Reason for Admission

52 yowf presented to the Emergency Department with neck pain radiating to the left arm that started this morning.

Admitted to the hospital after elevated troponin levels seen in blood work

## Anthropometrics

Height: 163cm (5'4")

Weight: 53.3kg (117 lbs)

BMI: 20.06 (normal)

UBW: 58.2kg in June 2020- **8% loss x 9 months**

## Social History

Single, has a sister

Legal guardian  
Court deemed her incapacitated

SSI/SSDE, unemployed

Staywell medicaid

Dialysis T/Th/Sat at Da Vita Mt. Dora

Relocated here from Miami in November 2018

# Focus of Study

**Hemodialysis patient's risk for developing heart disease**

**Nutrition interventions that could improve patient's risk of mortality**

**Emphasis on plant forward diet**



# Past Medical History



COPD

Alcohol and Polysubstance Abuse

Hypertension

Seizures

Depression

Noncompliance with dialysis  
sessions

Family History of COPD

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Medication	Drug Class	Food/Drug Interaction	Side Effects	Probiotic	Treat diarrhea	Contraindications in immune suppressed due to risk of sepsis	May cause diarrhea at high doses	
Furosemide (Lasix)	Loop diuretic	Natural licorice may counteract diuretic effect of drug	Increases urinary excretion of sodium, potassium, magnesium, and calcium	Clonidine (Catapres)	Alpha Adrenergic Agonist	Increases sensitivity to alcohol, which may increase sedation and drowsiness	Dizziness, drowsiness	
Amlodipine (Norvasc)	Calcium Channel Blocker	Avoid natural licorice	Dysphagia, nausea, cramps, and edema		Acetaminophen (Tylenol)	Non-Narcotic Analgesic	Avoid/limit alcohol	May cause hepatotoxicity at high doses
Losartan (Cozaar)	Angiotensin II receptor Blocker	Avoid natural licorice and salt substitutes, grapefruit and related citrus	Increase serum potassium		Famotidine (Pepcid)	H2 receptor blocker	N/A	May reduce absorption of vitamin B12 and iron
Sevelamer Carbonate (Renvela)	Phosphate Binder	Do not take with alongside a multivitamin or other medications that can be affected by changes in blood levels	Belching, sour stomach, excess air or gas in the stomach or intestines, full feeling	Metoprolol (Tenormin)	Beta-Blocker	Avoid alcohol, which can increase drowsiness.	May decrease insulin release in response to hyperglycemia	
				Pantoprazole (Protonix)	Proton-Pump Inhibitor	May interact with blood thinners, digoxin, diuretics	Headache, nausea, vomiting, abdominal pain, gas	
Calcium Acetate (PhosLo)	Phosphate Binder	N/A	Abdominal pain, confusion, constipation, depression	Zofran	Prevents N/V	N/A	Diarrhea or constipation, headache, drowsiness	
Lactulose	Osmotic laxative	N/A	Dehydration, diarrhea, high blood sodium, N/V					



# Anatomy and Physiology

# End Stage Renal Disease (CKD stage 5)

- ¾ million Americans living with ESRD
- Kidney function falls below 15%
- Main risk factors: Diabetes and Hypertension
- Symptoms: anorexia, N/V, fatigue, muscle cramps, anuria
- Treatment: dialysis or kidney transplant



JL is undergoing hemodialysis treatments

- Blood flows through an artificial kidney, which removes excess waste and fluids
- Requires permanent access to the bloodstream via a fistula
- Done at a dialysis center for 3-5 hours typically 3 times per week

# ESRD and Cardiovascular Disease

- ½ of deaths in people with ESRD are due to cardiovascular disease
- Chronic inflammation
  - Fistula in hemodialysis patients
  - Decreased nitric oxide production
    - Leads to LDL oxidation
  - Oxidative stress
  - Fluid overload between dialysis sessions
  - Gut dysbiosis
    - Elevated ammonia levels- elevated pH in the GI
    - Low fiber diet
    - Medications
  - Retention of uremic toxins
- Decreased erythropoietin production
  - Decreased RBCs, decreased oxygen delivery
- Vascular calcification
  - Elevated calcium and phosphorus in the blood





# JL Update

## Hospital days 1-4

Elevated Troponin secondary to kidney disease

- Regulate muscle contraction
- Sensitive biomarker for myocardial injury

Anemia of chronic inflammation

- Low Hgb
- Normochromic anemia

Cardiac procedures

- TEE
  - Mitral and tricuspid valve regurgitation
  - Pulmonary hypertension
- Cardiac catheterization
  - Nonobstructive CAD

Surgical Intervention

MVR and TVR

	Lab value	Reference ranges (normal for a dialysis patient)	Possible Indication for abnormal lab value
Sodium	132 mEq/L (low)	135-145 mEq/L	Hypervolemia
Potassium	5.3 mEq/L	3.5-5.5 mEq/L	
Chloride	91 mEq/L (low)	100-110 mEq/L	Hypervolemia
Glucose	81 mg/dL	<100 mg/dl (fasting) <140 mg/dl (2 hour postprandial)	
Calcium	10.0 mg/dL	8.6-10 mg/dL	
BUN	43 mg/dL	50-100 mg/dL	
Creatinine	5.6	Less than 15	
HgbA1c	5.0%	<5.5%	
GFR	10.6	<15 for ESRD	
Albumin	4.0	>4.0	
Hgb	9.8 g/L (low)	11g/L	Anemia
Hct	30.6% (low)	37-47%	Anemia, hypervolemia
PT	16.5 (high)	12-14.4	Vitamin K
INR	1.47 (high)	0.88-1.12	Vitamin K
Troponin	109, 117 2-hours later (high)	<14 ng/L	Myocardial injury



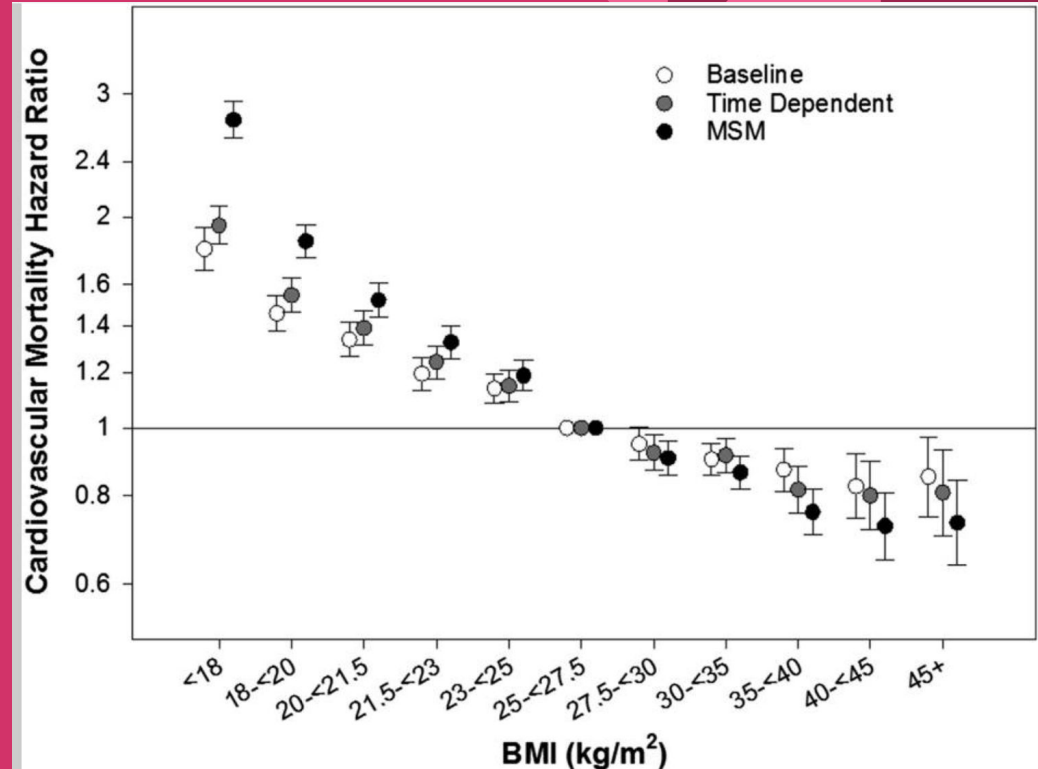
# Medical Nutrition Therapy

# JL's Nutrition Risks

- 8% weight loss x past 9 months
- BMI 20- Obesity Paradox
  - Cardiovascular mortality decreases as BMI increases
  - Protective against cachexia

## BMI as a Predictor of Mortality

- 1.1.7 In adults with CKD 5D on PD, we suggest that underweight status (based on BMI) can be used as a predictor of higher mortality (2C).
- 1.1.8 In adults with CKD 5D on MHD, we suggest that overweight or obesity status (based on BMI) can be used as a predictor of lower mortality, whereas, underweight status and morbid obesity (based on BMI) can be used as a predictor of higher mortality (2B).



# JL's Current Nutrition Situation

## Diet Order

- Heart Healthy Cardiac, Low Sodium (2g/day), low phosphorus, and low potassium with a 1500 mL fluid restriction
  - Provides 1889 kcals and 105 grams protein per day

## Estimated needs

- Kcals: 1865 kcals/day (35kcal/kg- HD, at risk of malnutrition)
- Protein: 64-70g/kg (1.2-1.3g/kg ABW- HD)
- Fluid: 1500 mLs (FR)

## Averaging eating 90-100% of meals

- Currently meets: 90% calorie and 135% of protein needs



# Initial Interview with JL

Interested in nutrition

States readiness to change

Discouraged with her current diet

- Sad she can't eat some of her favorite vegetables
- Chicken, fish, white rice
- Regular diet (outside of the hospital)
  - Lacks fruit and vegetables
  - Low in calories and fiber
  - Adequate protein

Claims to have only seen a dietitian twice before at her dialysis center, not recently

PES statement:

Nutrition-related knowledge deficit related to ESRD as evidenced by her diet recall and 8% weight loss over the past 9 months

Meal Period	Food Consumed	Nutrient Breakdown
Breakfast	2 hard boiled eggs 1 piece of white toast 1 tbsp grape jelly	210 calories 9g fat 220mg sodium 0mg potassium 14g protein
Lunch	1 cup white rice 1 4-oz boneless, skinless chicken breast 1 cup water	403 calories 4g fat 52mg sodium 300mg potassium 41g protein
Dinner	1 cup white rice 1 4-oz tilapia filet	305 calories 3g fat 77mg sodium 0mg potassium 24g protein
Snack	3 cups popcorn, popped	100 calories 1g fat 2mg sodium 75mg potassium 3g protein
Total		1018 calories 17g fat 351mg sodium 375mg potassium 82g protein



# Intervention: Nutrition Education

# Phosphorus

- Not easily removed by dialysis
- Cardiovascular risk
  - High levels- vascular calcification
- Medications
  - Phosphate binders, eaten with every meal
  - Renvela
- Bioavailability
  - Inorganic Phosphorus: Up to 100% absorbed
  - Organic Phosphorus (animal): Up to 80% absorbed
  - Organic Phosphorus (plant): 30-40% absorbed
    - Phytates
- JL given a handout of phosphorus containing foods
- JL's response
  - Cut out soda previously
  - Open to adding hummus and possibly whole grains
  - Complies to her phosphate binder

## 6.3 Statements on Phosphorus

### Dietary Phosphorus Amount

6.3.1 In adults with CKD 3-5D, we recommend adjusting dietary phosphorus intake to maintain serum phosphate levels in the normal range (1B).

### Dietary Phosphorus Source

6.3.2 In adults with CKD 1-5D or posttransplantation, it is reasonable when making decisions about phosphorus restriction treatment to consider the bioavailability of phosphorus sources (eg, animal, vegetable, additives) (OPINION).

### Phosphorus Intake With Hypophosphatemia

6.3.3 For adults with CKD posttransplantation with hypophosphatemia, it is reasonable to consider prescribing high-phosphorus intake (diet or supplements) in order to replete serum phosphate (OPINION).

# Potassium

- Typically excreted via urine, can be removed by dialysis
  - fecal excretion elevated in HD patients
- Cardiovascular risk
  - Elevated levels- cardiac arrhythmias and cardiac arrest
- Found in many fruits and vegetables
- Additive in meats
- JL provided a list of potassium containing foods
  - <200mg Potassium choices
- JL's response
  - Happy to see the list of low potassium fruit and vegetable choices

## Further Research to Be Done!

- Dietary potassium may not effect serum potassium
- Adding more F/V - increased fiber intake - reduce risk of constipation - increase potassium excretion via bowels

## 6.4 Statements on Potassium

### Dietary Potassium Amount

6.4.1 In adults with CKD 3-5D or posttransplantation, it is reasonable to adjust dietary potassium intake to maintain serum potassium within the normal range (OPINION).

### Dietary and Supplemental Potassium Intake for Hyperkalemia or Hypokalemia

6.4.2 In adults with CKD 3-5D (2D) or post-transplantation (OPINION) with either hyperkalemia or hypokalemia, we suggest that dietary or supplemental potassium intake be based on a patient's individual needs and clinician judgment.



# Sodium

- Lower sodium diet recommended for fluid and control hypertension
- Cautious of salt substitutes
  - Contain potassium
- JL's response
  - Brought this topic up herself
  - Already has a good base knowledge
  - Doesn't use salt in her cooking
  - Discussed Mrs. Dash seasoning

## 6.5 Statements on Sodium

### Sodium Intake and Blood Pressure

6.5.1 In adults with CKD 3-5 (1B), CKD 5D (1C), or posttransplantation (1C), we recommend limiting sodium intake to less than 100 mmol/d (or <2.3 g/d) to reduce blood pressure and improve volume control.

### Sodium Intake and Proteinuria

6.5.2 In adults with CKD 3-5 we suggest limiting dietary sodium intake to less than 100 mmol/d (or <2.3 g/d) to reduce proteinuria synergistically with available pharmacologic interventions (2A).

### Sodium Intake and Dry Body Weight

6.5.3 In adults with CKD 3-5D, we suggest reduced dietary sodium intake as an adjunctive lifestyle modification strategy to achieve better volume control and a more desirable body weight (2B).

# Protein

- At risk of protein energy wasting
  - Dialysis may promote protein catabolism
- Low albumin levels
  - Predictive of poor survival
  - Doesn't reflect nutritional status
  - Federal mandates require nutrition intervention when albumin falls below 4g/dL
    - JL's albumin at 4.0g/dL
- JL's response
  - JL states she is not vegetarian, but does enjoy nuts and hummus
  - Understood importance of protein in her diet

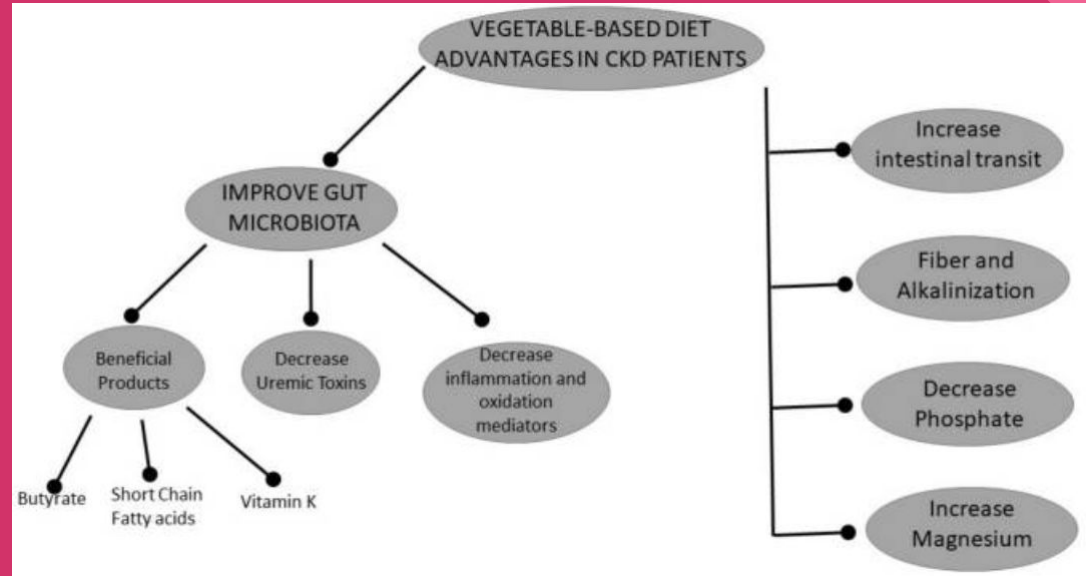
## Serum Albumin Levels

1.2.2 In adults with CKD 5D on MHD, serum albumin may be used as a predictor of hospitalization and mortality, with lower levels associated with higher risk (1A).

# Summary: Plant-Based Nutrition and Improving Cardiovascular Risk in Patients on Hemodialysis

## CVD risks in HD patients

- Chronic Inflammation
  - Fistula
  - Decreased NO
  - Oxidative stress
  - Fluid overload
  - Gut dysbiosis
  - Retention of uremic toxins
- Benefits of more vegetables
  - Antioxidants- reduce oxidative stress
  - Fiber- improve gut dysbiosis, reduce production of uremic toxins
  - Mg- protect against vascular calcification
  - Lower phosphorus absorption



# Conclusion

Follow-up scheduled for after heart surgery

Receptive of the information provided

Give handouts to her legal guardian

Have groceries ready for her upon discharge

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# Prognosis

# Status Post Surgery

- Day 1
  - Successful surgery
  - Little slow to extubate
- Day 2
  - Diet just advanced to clear liquids
  - Feeling groggy, appetite slightly decreased
  - Willing to drink Nepro
- Day 4
  - Diet advanced to pre surgery diet
  - Drinking Nepro 2/day
  - Averaging 90% of meals
  - Motivation to improve her diet

## Goals Upon Discharge

- Follow-up with dietitian at Da Vita
  - Monitor and Evaluation
    - Labs, weight, diet recalls
- Compliant with dialysis sessions
- Add more vegetable foods
- Gain weight
- Keep renal labs WNL
  - K, Phos, Ca, Albumin
- Compliant with Medications
  - Blood pressure, phosphate binder



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