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Nutritional management of the patient with end-stage renal disease Case Study: dialysis case ;protein –energy wasting and comorbidities disease.

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Abstract :

This case study focuses on the nutritional management of a 65-year-old male patient with end-stage renal disease (ESRD) secondary to long-standing, uncontrolled type 2 diabetes mellitus. The patient has been maintained on hemodialysis for three years and presents with progressive unintentional weight loss, muscle wasting, chronic inflammation, and multiple comorbid conditions including hypertension and ischemic heart disease. Clinical assessment indicates significant protein-energy wasting (PEW), fluid overload, intradialytic hypotension, and reduced appetite.

The study emphasizes the importance of comprehensive nutritional assessment and individualized dietary planning to manage malnutrition-inflammation syndrome in dialysis patients. Key management strategies include optimizing protein and energy intake, controlling fluid and electrolyte balance, managing gastrointestinal symptoms affecting food intake, and providing continuous follow-up to ensure adherence and clinical stability. Effective collaboration between dietitians, nephrologists, and the patient is essential to prevent further nutritional decline, improve functional status, and enhance quality of life.

Keywords:
(End-stage renal disease (ESRD), Hemodialysis, Protein-energy wasting (PEW), Nutritional management, Chronic inflammation)

Case study concept

- **Management of client with impaired intellectual function**
- **Interpretation of clinical data**
- **Nutritional management of malnutrition –inflammation syndrome in dialysis**
- **dietary intervention- management of symptomatology -conservative management and follow-up arrangements**
- **Study context: chronic renal failure –hemodialysis- type 2 diabetes-ischemic heart disease-malnutrition-chronic inflammation.**

Case Scenario

- **A 65-year-old man who has ESRD, secondary to long standing , uncontrolled diabetes mellitus , He has been on dialysis for three years three time a week and he had multiple and extended hospitalizations.**
- **recently he noted loss of body weight.**
- **past medical history included type 2 diabetes mellitus, hypertension,**

(25years ago),ischemic heart disease, chronic inflammation

- **His surgical history included hernia repair, and AV Fistula placement.**
- **Reported symptom : poor appetite , fatigue, occasional intradialytic hypotension,**
- **On clinical examination : patient presenting with clinical signs of muscle wasting. fluid overloads were observed while his intradialytic weight gain, pitting oedema (extremely oedematose lower limb) ,pallor , pleural effusion , and anuria.**
- **Previous body weight 70kg**
- **Pre-dialysis weight 66kg**
- **Post dialysis weight 63kg)**
- **He lost 10%unintentional weight loss over 5months.**

(assessed by use ISRNM Diagnostic Criteria for PEW)

- **Height 175cm**

BMI: 20.5kg/m2
Laboratory investigations

	Ref. range in blood --- in urine (24hrs.collection) for the patient in blood
Sodium (mmol/L)	**135-145mmo/l** **<40mmol/l** **132**
Potassium (mmol/L	**3.5-5mmol/l** **25-125mmol/l** **6**
Urea (mmol/L)	**20-53 mg/dl** **120**
Creatinine (µmol/L)	**men 0.7-1.5mg/dl** **6** **women 0.6-1.2mg/dl**
Calcium (mmol/L)	**8.5-10.5mg/dl** **100-300mg/day** **6**
Phosphate (mmol/L) **7**	**2.5-4.5mg/dl**
• **Albumin**	**3.5-5g/dl** **<30mg/24hrs**
• **Pre-Albumin**	**2.8gldl**
• **CRP**	**16-35mg/dl**
• **Hb**	**10 mg/dl**
• **Post prandial blood sugar**	**<3 mgll** **24mg/l** **7.3 gm/dl**
• **Lipid profile – TC**	**200mg/dl**
• **Triglyceride**	**95mg/dl**
• **Urine output**	**170mg/dl** **Cease**

Drug history.

Medication	Indication/Class	Side Effects/Nutrient
Aspirin	Anti-coagulant, NSAID	Dyspepsia, heartburn, nausea/vomiting, stomach pain
Isosorbide Dinitrate	Angina, nitrate	Nausea
Remeron	anti-depressant	Somnolence, xerostomia, increased appetite, constipation
Maalox	Hyperphosphatemia, phosphate binder	Constipation ,stomach cramps, aluminum
toxicity, anemia	Reduce Ph , iron ,Ca, Mg	
Nephron-cap	Renal multi-vitamin(replace water soluble vit.	-------- ----------
Enalapril	Control blood pressure , reduce proteinuria and for IHD	Risk of hyperkalemia.
Lasix (furosemide)	Loop diuretic, edema,	Loss of K, Na, Ca ,Mg, and B1 loss
Atorvastatin	slow progression of atherosclerosis ,low LDL	Grapefruit juice Inhibit CYP3 enzyme led to increase blood levels increase risk muscle toxicity.
Resonium powder	Treat hyperkalemia , sodium polystyrene sulfonate, K-binding resin	Increase Na load ,Ca and Mg depletion , interfere with absorption of other medication, separate by > 3 hrs. from resonium
EPO(Epoetin alfa)	Anemia in CKD	Headache, high Bp
Insulin(Lantus)	Control blood sugar, low and titrate slowly	Risk of hypo during or after HD.
Norvasc	Hypertension, angina, calcium channel blockers	Edema, Nutrient interaction: grapefruit

Nutrition Challenges

Protein-energy wasting

- **Distinguishing between malnutrition and inflammation-driven hypoalbuminemia**
- **Protein needs during catabolic inflammation.**
- **Disturbed calcium-phosphate balance**

Chronic inflammation

- **High CRP, low albumin**

Comorbid burden

- **Diabetic nephropathy**
- **Ischemic heart disease**
- **Hypertension**

Micronutrient concerns

- **Risk of water-soluble vitamin loss (B, C, folate)**
- **Iron deficiency.**

Dialysis-related complications

- **Intra-dialysis hypotension may limit oral intake(pre-post-dialysis)**
- **Appetite suppression post dialysis**

Discussion points

- **Assessment and main nutritional issues for patient**
- **causes for malnutrition(risk of malnutrition in maintenance hemodialysis (MHD) patients and methods for preventing)**
- **How to assess nutritional status beyond albumin (SGA,MIS Malnutrition inflammation score)**
- **Role of intradialytic parenteral nutrition(IDPN) guidelines KDOQI and ESPEN**
- **Protein intake strategy: should increase to 1.2g/kg/day despite uremic risk , type of protein ,Energy ,and fluid.**
- **Anti-inflammatory nutritional strategies :Omega-3 supplementation**

- **Appetite stimulants and nutritional counseling**
- **Micronutrient correction : water soluble vitamin, iron supplement**
- **Metabolic complication : how control K,P without induced malnutrition**
- **Effect of medication on patient condition , nutritional status ,and RFT**
- **Would a plant –based diet be feasible here?**

How to assess nutritional status beyond albumin (SGA,MIS Malnutrition inflammation score)

- International Society of Renal Nutrition and Metabolism (ISRNM) and Kidney Disease Outcomes Quality Initiative's (K/DOQI) has encouraged using the term protein-energy wasting (PEW) "to describe states of under-nutrition.
- ISRNM Diagnostic Criteria for PEW(Ref. 2)
- Serum Chemistry: Serum Albumin < 3.8 g/mL Serum Pre-Albumin < 30 mg/mL for MHD patients Serum Cholesterol < 100 mg/mL
- Body Mass: BMI < 23 Unintentional Weight loss over time: 5% over 3 months or 10% over 5 months
- Reduced Mid-Arm Circumference area (reduction > 10%
- Unintentional low dietary protein intake of < 0.8 g/kg/d for at least 2 months for dialysis Unintentional low dietary energy intake of < 25 kcal/kg/d for at least 2 months
- Additional measures multiple laboratory markers (such as specific markers of inflammation), and also integrative nutritional scoring systems (subjective global assessment of nutrition and malnutrition-inflammation score)(Ref.3)
- Other evidence reported in the American Journal of Kidney Diseases, Malnutrition-Inflammation Score (MIS) as the gold standard. They reported the MIS to be "associated with inflammation, nutritional status, quality of life (Ref.4)

causes for malnutrition(risk of malnutrition in maintenance hemodialysis (MHD) patients and methods for preventing)

- The K/DOQI Guidelines developed by the National Kidney Foundation outline the following causes for malnutrition (1):
- 1. Inadequate nutrient intake related to anorexia, altered taste, chewing/swallowing difficulties, other disease states, restrictive diet and emotional troubles
- 2. The catabolic state of the patient
- 3. Dialysis treatment
- 4. Inflammation
- 5. Blood loss
- 6. "Possibly the accumulation of endogenously formed uremic toxins or the ingestion of exogenous toxins"

Assessment and main nutritional issues experienced by patient.

- In this case , patient was experienced with fatigue and felt unwell, albumin levels dropped ,TC low , he had a decrease in weight of >10% over 5 month and underwent multiple hospitalizations. This indicated decreased appetite and some degree of malnutrition. His BMI was 20.5 based on his most recent weight.

NKF and KDOQI concluded.

1. patients who were at high risk had more frequent and longer hospital admissions therefore they recommend "aggressive nutritional counseling and interventions" that include adequate intake of calories and protein and if need be, the use of oral supplementation.
2. patients who are unable to meet their nutritional needs by mouth, should be offered nutrition support.
3. Nutrition intervention should begin with an oral supplement If oral supplementation is not tolerated or is not providing enough calories and protein, a tube feeding may be considered. If tube feeding is not appropriate, then interdialytic parenteral nutrition (IDPN) may be an option (Ref.1,6,7).

Role of intradialytic parenteral nutrition(IDPN) guidelines KDOQI and ESPEN(6,8)

- Intradialytic parenteral nutrition special form nutritional support administration intravenous during dialysis session for patient with PEW (Guidelines by KDOQI and ESPEN)
- to improve albumin levels, nitrogen balance and clinical outcomes, reduce hospitalization rates.
- Modular supplements e.g. anticatabolic formulas was indicated for PEW , inflammation.

Dialysis-related complications

Intra-dialysis hypotension may limit oral intake(pre-post-dialysis)

- Eating meal or drink oral nutrition supplements during hemodialysis sessions can be an effective strategy to increase total energy and protein intake for individuals who are hemodynamically stable and have no contraindications for eating during hemodialysis.
- eating during HD may not be appropriate for all individuals. Therefore, recommendation should be individualized.
- Associated benefit and possible contraindications to eating during dialysis (Ref. 4)

Associated benefits	Possible contraindications
• Improvements in nutritional status • Improved quality of life Improved physical function	• Low blood pressure(hypotension) • Frequently coughing or risk of choking • Diarrhea • Indigestion Nausea or vomiting during treatment

Metabolic complication : how control K,P (Ref.8)

- Best practice nutrition recommendation based on serum potassium levels

✓ No restriction unless hyperkalemia present

- ✓ potassium binding resins e.g. Sodium polystyrene sulphate (resonium) used in case of hyperkalemia persist.

Serum ph. is raised in CRD due to decrease capacity to excrete Ph. Via the kidney.

- High S. Ph. Level
- ✓ Contribute to development of secondary hyperparathyroidism.
- ✓ Increase the risk of renal bone disease and soft tissue calcification.
- ✓ Have been associated with increase mortality in patients with CRD and ESRD
- ✓ Ph. Binder bind phosphorus in the gut reducing intestinal absorption.

Anti-inflammatory nutritional strategies :Omega-3 supplementation

- Use omega 3 fatty acid is one of anticatabolic supplement , anti-inflammatory and antioxidant.
- Reduce free radical, reduce pro-inflammatory like cytokines.
- omega-3 supplementation leads to a significant decrease in serum levels of CRP.
- It may improve appetite and reduce catabolism (Ref.7)

Would a plant –based diet suitable for HD patients ?
increasing the proportion of plant-based protein intake in patients with ESRD may improve.

- Renal outcomes, correcting metabolic acidosis
- Have antioxidant-- reduce free radical.
- Have bioactive phytochemical compound
- improved insulin sensitivity
- lower serum blood urea nitrogen, serum creatinine levels ,and proteinuria
- Slow decline in GFR
- Suppress inflammatory cytokines.
- Gut microbiota balance (Ref. (8,9)

Recommended dietary prescription at dialysis day and interdialytic period for patient (Ref. NKF, KDOQI(Ref.10,11.)

Prescription	Traditional method CRF(intradialytic	Traditional method at day of dialysis	NKF method
Energy	HB equation 66.5 + 13.8 W + 5.0 H – 6.8 A	HB equation 66.5 + 13.8 W + 5.0 H – 6.8 A	30-35 Kca/kg IBW or ABW ef
Protein	0.6-0.8 g/kg+ 24hr urinary loss	1-1.2g/kg/d+10-13g loss during day of HD	1.1-1.4 gm/kg BW or ABW ef
Carbohydrate	50%-55%	50%-55%	50%-55%
Fat	NCEP step 2	NCEP step 2	NCEP step 2
Fluid	24hr.urin output +insensible loss 500-1000	24hr.urin output +insensible loss 500-1000	24hr.urin output +insensible loss 500-1000
Sodium	60-90mq/d	60-120mq/d	2-3 gm/day Individualized
Phosphate	30mmol/d	30mmol/d	30mmol/d
• **Potassium**	60-70mq/d	60-70mq/d	2-3 gm/day Individualized

- **Macronutrients and micronutrients requirement at the of dialysis**
- depend on The NATIONAL KIDNEY FOUNDATION (NKF) and Kidney Disease Outcomes Quality Initiative (K/DOQI) to be used for nutritional guidelines for renal patients.

- **1. Traditional method**
- **Energy recommendation** : we will use HB equation.
- **Energy requirement** =2000kcal/d

Protein requirement : Amount of total and type of protein : in grams/day Protein for HD =1-1.2gm/kg+10-13grams(lost in dialysis)+24hrsurinary protein loss.

- which weight to take to calculate protein requirement?
- Normal weight= use oedema free body weight (post dialysis weight) Underweight= use ideal body weight(IBW) Overweight or obese = If % IBW >125% use adjusted body weight(ABW)
- Step 2: Calculate IBW when height is175 cm, gender is male and frame size is medium.
- IBW using Hamwi formula= IBW = No of inches above 5 feet X 6 + 106

IBW=72kg 2.2

% IBW = Present body weight X 100 =87.5%

Ideal body weight

From interpretation the patient was mildly undernutrition

We will use ideal body weight.

At the day of dialysis =1x72+10=82g/d 50% HBV and 50% LBV

1.2x72+10=96g/d

For intradialytic period (CRF)=0.6x72=43g/d 0.8x72= 58g/d

NKF method

- **Energy recommendation:** 30-35kcal/kg/d
- 30x72=2160=2200kcal/d
- 35x72=2520=2500kcal/d
- **Protein recommendation**
- Categorization of patients based on their current
- If % ideal body weight (calculated IBW using Hamwi formula) was < 90 % of weight---------- Underweight (UW) then Ideal Body Weight will be used
- 90-115 % of weight --------- Normal weight(NW) oedema free weight (weight free oedema) will be used

- > 115 % of weight--------- Over weight(OW) Adjusted oedema free body weight will be used.
- We will use IBW.
- 1.1 -1.4 g/kg/d
- 1.1x72= 79g/kg/d
- 1.4x72=101g/kg/d

Fat and saturated fat

- Use NCEP step2.
- T.F < 30%,Sat.fat <7%,T.C <200, PSF=10% ,MSE=15%
- T.F = 62g/d
- Sat. Fat =13g/d
- **Carbohydrate** 55%
- The requirement = 275g/d
- **Fluid requirement** =insensible loss +24hr. Urine output
- 500-1000ml/d as urine output cease
- Including syrup medication (Resonium powder)
- As the patient should intake 3 times /day in 40 ml of water

Electrolytes

- Daily allowance of sodium is 60-120 meq/day, usually 90 meq/day.
- To avoid hyperkalemia dietary potassium should be restricted to 60-70 meq/day.
- Patient on Lasix for reduce oedema and it will increase loss of K and Na
- Other medication to reduce oedema and reduce proteinuria is ACE inhibitor which is increase the risk of hyperkalemia.
- Ros onium powder for treat hyperkalemia , the mode of action bind with K ion in intestine and exchanges them for Na may increase Na load .
- Therefore, should monitoring and reviewing of the electrolytes.

Phosphorus

- Hyperphosphatemia is a problem in the majority of HD patients.
- The treatment is aimed to:
- Restriction of dietary phosphate to 30mmol/day
- Use phosphate binders to limit phosphate absorption.
- Preventing hypocalcemia
- Supplementation with active Vit. D

Micronutrient Supplement

- supplementation with **multivitamins**, including all the water-soluble vitamins.
- prescribing **folate, Vit B12 ,B-complex** supplement to correct for folate or Vitamin B12 deficiency/insufficiency based on clinical signs and symptoms.
- prescribing **vitamin D** supplementation in the form of cholecalciferol or ergocalciferol

National Renal Exchange list
Ref. Renal Dietetic practice group of American dietetic association (1993)
National Kidney Foundation (2020)

- Plan a diet for this patient based on his nutritional goals for energy, total proteins, types of protein, total fat, CHO, sodium. Potassium and fluid.
- Start with protein HBV (animal source and LBV (plant source) put serving size depend on Food guide primed(2-4)
- Fat (total and sat. Fat) calculate the serving size by divide it by 5.
- Calculate Energy and CHO at same time.
- Calculate total Na ,K, if more than recommendation exchanges them to low Na and K food
- Calculate fluid if more than recommendation should be restricted.

Summery

- Malnutrition high prevalence among hemodialysis patients and increase morbidity and mortality. The detection and treatment of malnutrition in hemodialysis patients are a dietetic priority.
- Multiple factors have an adverse effect on the nutritional status of hemodialysis patients. Some are common on all CRF patients, and the others are specific to the dialysis treatment .
- In hemodialysis there are losses of amino acids during dialysis which cause protein catabolism.
- Under dialysis can also adversely affect nutritional intake, due to reduced appetite and subsequent reduced protein intake. As seen in this case, a dialysis patient's health can decline very quickly. With other factors complicating renal disease, dialysis patients are at high risk for malnutrition. In this case, decrease body weight within 5 months and chronic inflammation was mark for PEW , using a nutritional scoring system is an ideal and fairly easy tool for dietitians to use to assess malnutrition in these patient.
- The dialysis patient is at risk for deficiencies of water-soluble vitamins, particularly vitamin B_6 and folic acid, due to poor intake or loss of these nutrients during the dialysis procedure.
- An individualized nutritional education approach should be used with regular follow-up and counselling which are all important aspects of clinical management to improve patients' nutritional status.

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