Laboratory value in End-stage Renal Disease

- **EDUCATION UNIT of SAMIN TEB SOROOSH(SMARRT)**

Albumin

A good measure of health in dialysis patient.

Normal rang : 3.5-5.4 g/dl

CKD Normal rang :4g/dl

The risk of morbidity and mortality increase with serum albumin levels less than 3.5 g/dl.

If albumin levels are below 2.9 g/dl fluid will leak from the blood vessels into the tissue.

Low Albumin:

- Increase intake of protein-rich foods: meat, fish, chicken, eggs .
- A protein supplement may be needed
- Intravenous albumin corrects short-term problems with oncotic Pressure but does not change serum albumin levels.

Why do we monitor albumin levels so closely?

- **Hypoalbuminemia** :

1- Higher **hospitalization** rate

2- **Death** in dialysis patient

What is the relationship between Albumin & CRP?

- CRP is a protein produced in response to infection.
- Elevated serum CRP levels are associated with low serum albumin levels in dialysis patient.
- A combination of the two factors :

  1- heart disease

  2- inflammation of the blood vessels.

NORMAL RANG: 0-3 mg/l

Other factors associated with an increase in CRP levels : surgery, bio incompatible membranes, periodontal disease, high-flux dialysis

- CRP levels peak 2 to 3 days after an acute infection and to decrease 1 to 2 weeks after the infection subsides.
- INCREASE CRP:

1- low serum albumin levels

2- evaluate resistance to epoetin alfa (Epogen) therapy

3- assess the course of acute bacterial infection

4- detect occult infection or chronic inflammation.

CRP levels greater than 5 to 10 mg/l as being indicative of inflammation.

Ferritin

- This is how iron is stored in the liver.
- If iron stores are low, red blood cell production is decreased.
- Male: 20-350 mcg/l
- Female: 6-350 mcg/l
- Normal for people on dialysis: 300-800 mcg/l with EPO
- Normal for people on dialysis: 50 mcg/l without EPO

Ferritin

- Ferritin is a storage form.
- Stored in intestinal mucosal cells, liver, spleen & bone marrow.
- In the mucosal cells, ferritin is the temporary storage form of iron.

Low Ferritin is resulted because of:

- Iron in food is not well absorbed .
- Most patients need an IV iron supplement .
- Patients should not take oral iron at the same time as phosphate binders.

Transferrin

- In healthy people, about **20-40%** of available transferrin sites are used to transport iron.

Transferrin saturation is decrease with iron deficiency and increase when excess amount of iron are present , as in iron overload or poisoning.

Certain types of anemia due to **accumulated iron**:

Malnutrition(vit B12, folic acid) , Inflammation, liver disease , Nephrotic syndrome.

- TFS (Transferrin Saturation) % = Serum Iron/ TIBC (Total Iron Binding Capacity)

- In the hemodialysis patient with EPO:

  1- TFS > 20%

  2- SF> 100 NG/ML

Calcium

- Normal rang: 8.5-10.5 mg/dl
- Normal for people on Dialysis: 8.5-10.5 mg/dl
- Active vitamin D is needed for absorption.
- The calcium value multiplied by the phosphorus value should no exceed 55 or calcium will deposit in soft tissues .
- Calcium can be falsely lower if albumin is low. Ionized calcium is a more accurate test in this case.

High calcium

- Check with the doctor if the patient is taking calcium supplement
- Active vitamin D these should be temporarily stopped.

Low calcium

- If albumin levels are low, suggest an ionized calcium be drawn.
- The patient may need a calcium supplement between meals and active vitamin D .
- Check with the physician.

Corrected Calcium

- Each one gram change in serum albumin per deciliter changes the serum calcium concentration by 0.8 mg/dl. Normal serum albumin levels range from about 3.5 to 5.0 g/dl.

- In patients with below normal albumin levels, obtaining a corrected calcium value can make the difference between recognizing or missing an accurate diagnosis of real Calcium level.

Calculating Corrected Calcium

Albumin Corrected Calcium =

Serum calcium + [(4 -albumin) X 0.8] =Albumin Corrected Calcium

Example: Ca of 10.5 mg/dl & Alb of 2.5 g/dl:

= 10.5 + [(4 – 2.5) X 0.8] = 11.7 mg/dl

Laboratory data(cont)

- **پره آلبومین:** کمتر از ۳۰۰ mg/l مستقل از میزان آلبومین قویا پیش بینی کننده افزایش احتمال مرگ و میر است.

- **BUN قبل از دیالیز:**

سطح BUN قبل از دیالیز کمتر از ۵۰mg/dl اغلب ناشی از مصرف ناکافی پروتئین است.

- **کراتینین سرم:**

افراد با کراتینین کمتراز ۱۰ mg/dl باید از نظر سوء تغذیه بررسی شوند.

Laboratory data(cont2)

- **nPNA(nPCR):**

بیانگر تعادل نیتروژن بدن بوده و رنج نرمال آن g/kg/day ۱/۴ – ۱/۲ می باشد. اگر کمتر از g/kg/day ۱ باشد با افزایش بیماری و احتمال مرگ و میر در ارتباط است.

- **کلسترول سرم:**

مارکر با ارزش در بررسی وضعیت تغذیه ای بیماران دیالیزی و پیش بینی کننده افزایش احتمال مرگ و میر می باشد.

کلسترول سرم در mg/dl ۱۸۰-۱۵۰ و یا در حال کاهش باید از نظر احتمال سوء تغذیه بررسی شود.

Phosphorus

- Normal rang: 2.5-4.8 mg/dl
- Normal for people on Dialysis: 3-6 mg/dl
- Acceptable levels depend on a variety of factors, including: serum calcium, PTH levels, and the level of phosphorus in the diet.

High Phosphorus

- 800-1000 mg for patient (Limit milk and milk products to 1 serving/day)

- Remind patient to take phosphate binders as ordered with meals and snacks.

Noncompliance with binders is most common cause of high phosphorus levels.

Low Phosphorus

- Add 1 serving of milk products or other high-phosphorus food per day or decrease phosphate binders.

INTACT PTH

- Normal range: 10-65 PG/ml
- Normal for people on Dialysis: 200-300 PG/ml
- A high level of PTH indicates that calcium is being pulled out of bones to maintain serum calcium levels.
- This syndrome is called secondary hyperparathyroidism leads to Kidney osteodystrophy.
- Pulsed does of oral or IV vitamin D usually lower PTH.

DOQI guideline K/DOQI

Intact PTH (pg/ml)	× P Ca (mg/dl)	Ca (mg/dl)	P (mg/dl)	GFR (ml/min/1/73m²)	CKD Stage
۳۵-۷۰	۵۵ >	۸/۴-۱۰/۲	۲/۷-۴/۶	۳۰-۵۹	۳
۷۰-۱۱۰		۸/۴-۱۰/۲	۲/۷-۴/۶	۱۵-۲۹	۴
۱۵۰-۳۰۰		۸/۴-۹/۵	۳/۵-۵/۵	یا دیالیزی > ۱۵	۵

High AND LOW PTH TREATMENT

Contact the physician if the patients is taking oral or IV active v it D

If the patient has no symptoms(high phosphorus, bone pain, fractures)

Treat less aggressively.

LOW: NO treatment available

Creatinine

- Normal rang: 0.6-1.5 mg/dl
- Normal for people on Dialysis: less than 15 mg/dl
- Definition : A normal waste product of muscles breakdown

Assessment of creatinine

- Dialysis normally controls cr levels.
- Low cr may indicate:

1- good dialysis(kt/v, urea cl)

2- low body muscle(nutrition)

Urea Nitrogen(BUN)

- Normal rang: **7-23 mg/dl**
- Normal for people on Dialysis : **50-100 mg/dl**
- Definition: Waste product of protein breakdown.

High and low BUN

- **High BUN** : under dialysis :

1- check **ekt/v**

2- check **nPNA**

- **Low BUN:**

1- bad nutrition(weakness muscle)

URR and kt/v

- Normal rang: above 65% or 0.65
- No diet changes , but catabolism or anabolism will affect k t/v values.

K t/v:

- Normal rang:

1- Above 1.4 for hemodialysis and e kt/v =Above 1.2

2-Above 2 for peritoneal dialysis

Aluminum

- Normal rang: 0-10 mcg/l
- Normal for people on Dialysis: less than 40 mcg/l
- Function: patients are taking aluminum AL(OH)3 phosphate binders may develop AL toxicity.

  The level of AL should be checked every 6 month.

GOOD LUCK

