Albumin, Nutrition and IDPN

- What is Albumin?
- It is the most important serum protein (by quantity)
- The serum albumin is a measurement of the creation, removal, and distribution of this protein.
- The half life of albumin is 20 days – 4% degraded daily

What Determines the Level of Albumin?

- Nutritional Status
- Serum oncotic pressure (volume)
- Cytokines
- Hormones
- Inflammatory states inhibit albumin production

What is the Clinical Significance?

- Low albumin may be due to liver dysfunction, systemic inflammation, nephrotic syndrome

- Low albumin may be due to malnutrition

- The albumin concentration is a fair reflection of body protein stores
- Albumin has a long half-life and a large liver reserve therefore it show up late in the course of malnutrition
- Volume overload will lower the albumin level because of dilution.

Target Levels

- Albumin levels less than 3.0 g/dl-highest risk of death
- Albumin levels less than 3.5 – increased risk of death
- Albumin levels less than 3.8 suggests PEW (protein energy wasting)

- **Low serum albumin does not equal malnutrition or underdialysis**

- In 841 dialysis patients serum albumin correlated only mildly with poor nutritional status

- Some dialysis patients have a low albumin because of decreased albumin production despite good protein intake and adequate dialysis

- This can be due to an underlying INFLAMMATORY process

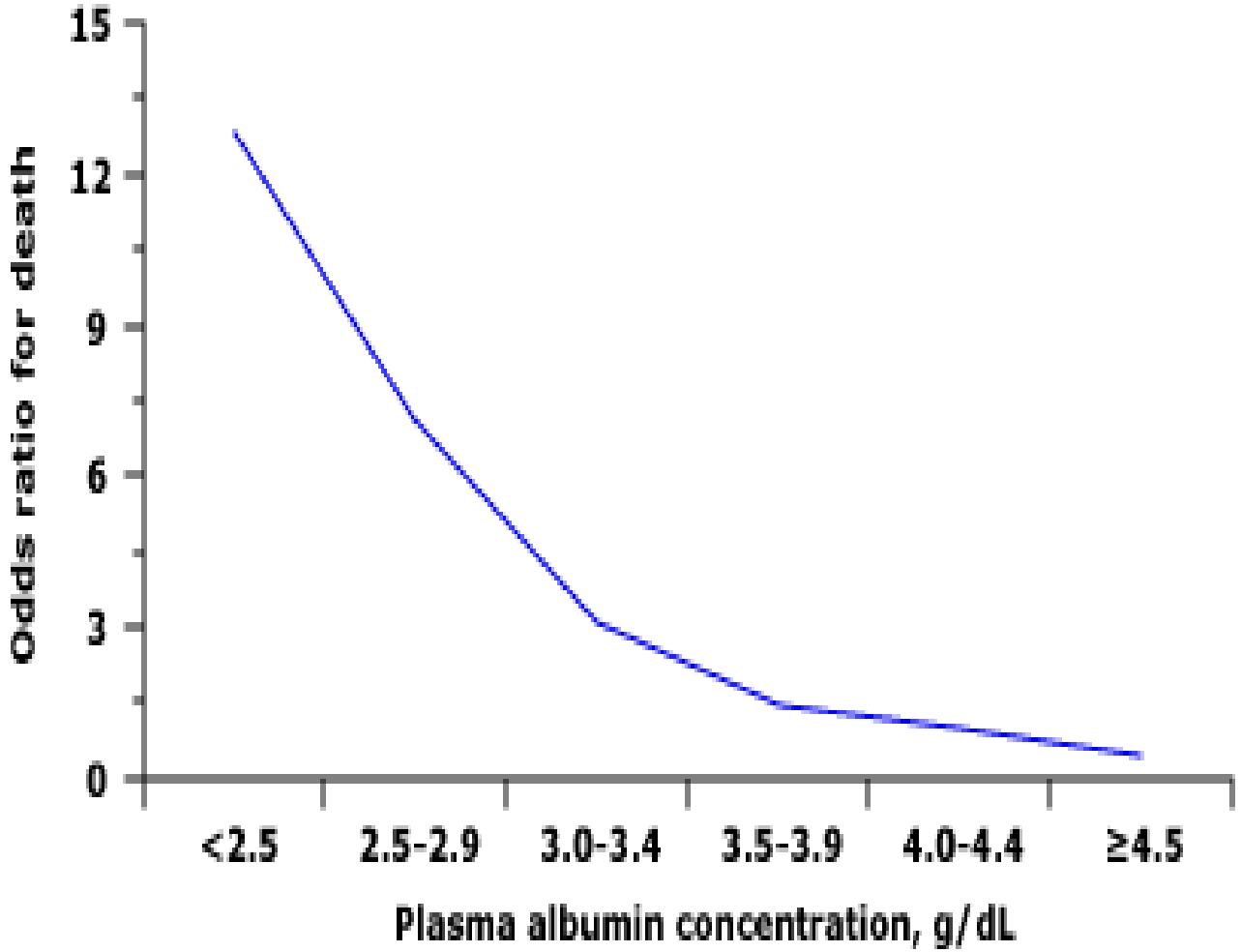
- The plasma TRANSFERRIN is another common measure for nutritional status.

- However, plasma transferrin values are often low in renal failure due to fluctuations of iron stores.

Diagnosis of PEW (Criteria)

- **Serum Chemistry**
- Serum albumin less than 3.8
- Cholesterol less than 100 mg/dl
- **BMI less than 23 kg/m$_2$**
- 5% weight loss over three months (or 10%x 6 m)
- **Total body fat %less than 10**
- Reduced muscle mass 5%x3 m or 10x 6 m
- **Low dietary protein intake less than 0.8 g/kg/day x 2 m (or energy intake less than 25 kcal/kg/day)**

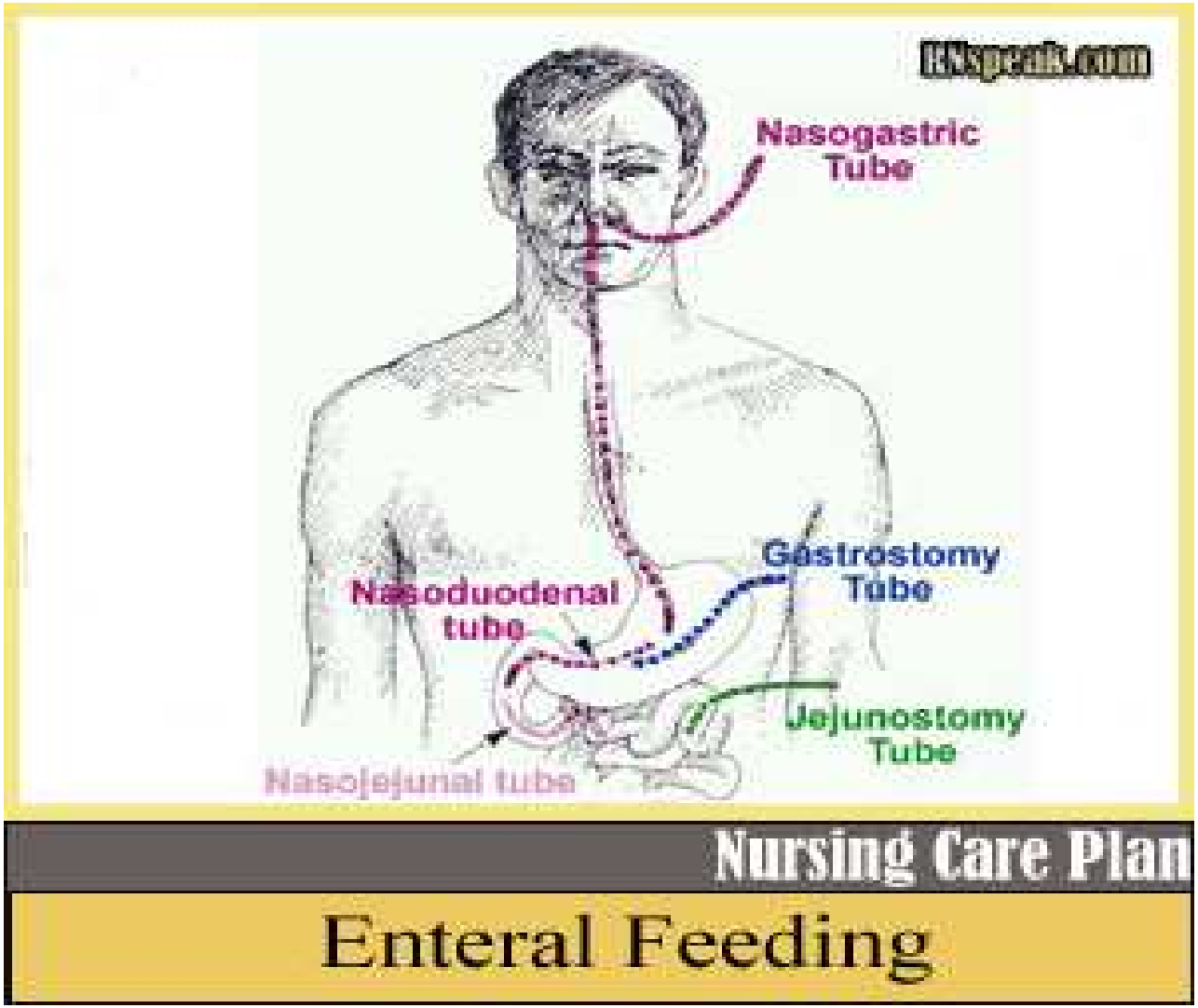
- Must have ¾ categories and at least one test in each of these categories to achieve the diagnosis.


15
12
9
6
3
0
Odds ratio for death
<2.5
2.5-2.9
3.0-3.4
3.5-3.9
4.0-4.4
≥4.5
Plasma albumin concentration, g/dL

- Even in well-dialyzed patients **factors that contribute to poor nutrition include:**
- Inflammatory response
- Nutrients are lost into the dialysate
- Dietary restrictions
- Catabolic dialysis procedure
- Metabolic acidosis causes protein degradation
- Gastroparesis
- Medications that impair nutrient absorption
- Increased levels of leptin (hormone that induces satiety)
- Chronic volume overload

Treatment of Poor Nutrition

- Manage inflammation
- Assess dietary intake
- Oral supplements (ODPS)
- Enteral feedings
- IDPN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Nasogastric Tube
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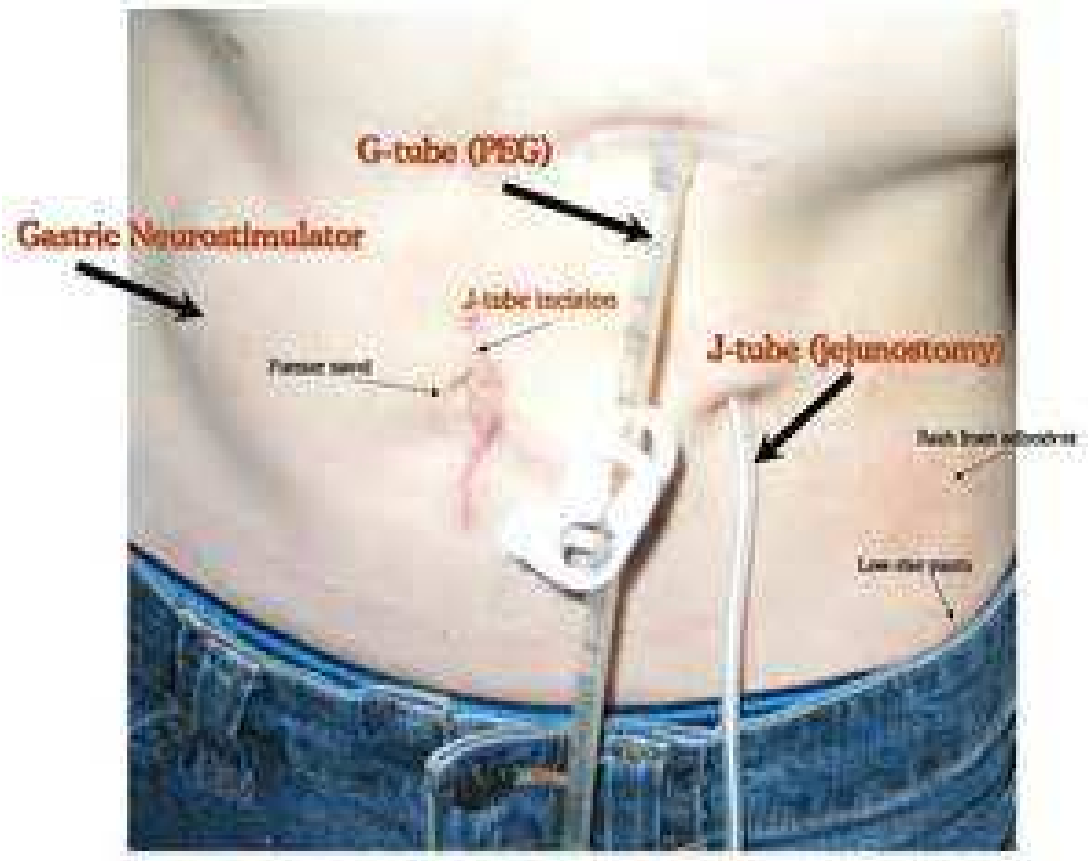
Nasoduodenal tube
Jejunostomy Tube
Nasojejunal tube
Nursing Care Plan
Enteral Feeding


G-tube (PEG)
Gastric Neurostimulator
J-tube (jejunostomy)

- Oral supplements given at the time of dialysis were shown to be effective in two studies. There was **improved survival** in the patients given the oral supplements.
- A retrospective study of supplements taken at non-dialysis times showed a lower rate of hospitalizations.
- Compared with IV nutritional supplementation –oral has less side effects and is more cost effective

- In severe anorexia, overnight nasoenteral feeding may be effective

- In Gastroparesis IDPN may be necessary

Limitations of IDPN

- **Most costly and least efficient** nutritional supplement costing sometimes two times as much as the dialysis itself.
- In some instances only **70% of the nutrients are actually delivered to the patient because of loss into the dialysate**
- It is only 3 days/week
- Can be associated with lower than expected delivered dose of dialysis

Is There a Role for Intradialytic Parenteral Nutrition?

Benefits

- Ease of administration with dialysis
- Do not need patient cooperation
- Composition can be regulated
- Excess fluid can be removed
- Convenient

Disadvantages

- Not effective as sole nutrient source
- Given IV and cleared very rapidly from blood
- Non-physiologic with short intense duration
- Expensive
- Time and effort from nursing staff
- Increased risk of infection
- Reactive hypoglycemia

What do the Studies Show?

- There are not a lot of robust Prospective Randomized Controlled trials
- 1 study with 26 patients-12 patients received IDPN with increased body weight, muscle circumference, albumin etc.
- The largest study with 186 patients with 93 receiving IDPN for one year 93 did not – everyone received oral supplements

- IDPN provided 6.6 kcal/kg/d
- Oral supplements provided 5.9 kcal/kg/d
- Both groups showed similar improvements in hospitalization rates and mortality (no significant difference between the groups)

- Indications for IDPN are difficult to define because the benefits of this treatment to ICHD patients have never been shown in RCT

- IDPN has been shown to acutely improve nutritional parameters but a decrease in morbidity and mortality with IDPN compared with patients that only used oral supplementation has NOT been demonstrated.

- IDPN has been used because it can supply rapidly a high quantity of nutrients but the majority of HD patients with PEW DO NOT have any digestive problems

- In a study comparing glucose and insulin levels in patients given IDPN versus *I*DON it was confirmed that the oral route is more physiologic. The carbohydrate load was similar (125 g/IDPN v. 116g/IDON
- The large increase in glucose with IDPN indicates an inability of the organism to adequately metabolize an IV load of glucose despite considerable increases in insulin.

- Hyperglycemia could have negative effects by:
- --increased generation of reactive oxygen species (activation of the inflammation cascade)
- --direct toxic effects on cells
- --impaired ability to resist infection
- --negative metabolic effects

Eating on Dialysis

- Eating during a hemodialysis treatment remains a controversial topic
- In 2011 a survey was conducted obtaining opinions regarding food consumption while on dialysis
- In 2014 there was a follow up survey done after providing clinicians with educational materials about eating during treatment

- **2011:** 343/1199 (28.6%) of clinics did NOT allow **eating** during treatment
- 222/1199 (18.2%) did NOT allow **drinking** during treatment
- **19/1199** (1.6%) did NOT allow eating at a facility before or after a treatment

- **2014:** 22.6% no eating
- **178** (6.8%) reported that eating was more allowed- this due to a shifted focus to nutritional status

- 53% of clinicians encouraged eating during treatment in 2014

- Medical Directors were less concerned about the reasons commonly cited for restricting eating during treatment

Advantages of Eating on Dialysis

- Offsets energy loss during dialysis
- Mitigate muscle wasting
- Patient satisfaction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Disadvantages/Risks

- Hemodynamic instability- studies show both ways
- Reduced dialysis efficiency-due to sequestration of blood in the digestive tract
- Nausea/vomiting
- Choking risk
- Forgotten binder doses
- Infection control issues

- Most dialysis clinics outside of the US encourage patients to eat on dialysis
- Meals are routinely offered to patients in most European/South East Asian countries
- Was practiced in the past in the US

Study Results FrEDI

- Fosrenol for Enhancing Dietary Protein Intake
- Prepared meal boxes (50 G protein 850 cal) on dialysis for 51/110 patients x 8 weeks (control group with low calorie meals and neg protein)
- Results showed increased albumin, NO adverse events and HIGH patient satisfaction with the high protein meals