

Proteins

Clinical Background

Hepatic proteins is a term used to refer to a group of proteins synthesized in the liver that may be used in the assessment of nutritional status. Hepatic proteins include

- Albumin
- Prealbumin (transthyretin)
- Retinol-binding protein (RBP)
- Transferrin

Etiologies

- Starvation
- Chronic disease
 - HIV
 - Malignancy
 - Chronic liver disease
 - Chronic kidney disease
 - Chronic obstructive pulmonary disease (COPD)
- Anorexia
- Malabsorption
- Critical illness or trauma

Pathophysiology

- Albumin
 - Function – carrier protein for minerals, fatty acids, vitamins and hormones; the most abundant protein in human plasma (55-65% of total protein content)
 - Most commonly monitored protein – long half-life (20 days) makes it a relatively insensitive marker
- Prealbumin (transthyretin)
 - Function – carrier protein for thyroid hormone
 - Prealbumin has 2-day half-life versus albumin (20-day half-life)
 - Short half-life makes it a good indicator for early monitoring
 - Unaffected by hydration status
- RBP
 - Function – responsible for binding and transporting retinol (vitamin A)
 - Short half-life (11 hours) makes it an excellent indicator of early malnutrition
- Transferrin
 - Function – carrier protein for iron
 - Presence of transferrin in serum and other body fluids aids in differential diagnosis
- Alpha-1-antitrypsin (fecal)
 - Function – protease inhibitor

Clinical Presentation

- Constitutional – weight loss, muscle wasting, fatigue, failure to thrive (children)
- Skin changes from vitamin deficiencies may occur in chronic loss
- Extremes – kwashiorkor manifesting with ascites, edema

Diagnosis

- Indications for testing
 - Patient with known disease that would cause compromised nutritional status (eg, cancer, malabsorption), children with failure to thrive
- Laboratory testing
 - Albumin – usual first line test in evaluating nutritional status
 - Elevated concentrations
 - Dehydration
 - Decreased concentrations are very common
 - Impaired synthesis
 - Primary (eg, liver disease)
 - Secondary (eg, low protein intake)
 - Increased catabolism – result of tissue damage and inflammation
 - Reduced absorption of amino acids – malabsorption or malnutrition
 - Excessive protein loss in urine, feces or skin – glomerulonephritis, nephrotic syndrome, protein losing enteropathy
 - Altered distribution that sequesters large amounts of albumin in extravascular compartment
 - Nephrotic syndrome
 - Congestive heart failure
 - Albumin measurement in urine may aid in early detection of renal involvement in chronic diseases
 - Prealbumin – may be a better early screening test due to short half-life
 - Prealbumin used as marker of nutritional status in
 - Premature infants
 - Cancer patients
 - Surgical patients
 - Prealbumin is a negative acute phase reactant
 - Due to decreased synthesis, prealbumin serum concentrations fall in
 - Inflammation
 - Malignancy
 - Cirrhosis of liver
 - Protein-wasting diseases of gut or kidney
 - Recommended protein measurement in evaluation of nutrition in hospitalized patients
 - RBP, transferrin and fecal alpha-1-antitrypsin – less widely used as screening tests
 - Decreased concentrations of RBP – cystic fibrosis, liver disease
 - Elevated concentrations of transferrin
 - Malnutrition
 - Acute inflammation
 - Infection
 - Renal disorders
 - Red blood cell disorders, including iron deficiency
 - High concentrations can occur in pregnancy and during estrogen administration
 - Decreased concentrations of transferrin
 - Transferrin is a negative acute phase reactant
 - Low concentrations occur in
 - Inflammation
 - Malignancy

- Chronic liver disease
- Protein loss
- Elevated fecal clearance of alpha-1-antitrypsin in protein-losing enteropathy
- Also recommend vitamin/mineral assay testing

Lab Tests

Indications for Laboratory Testing

Tests generally appear in the order most useful for common clinical situations. For test-specific information, refer to the test number in the ARUP Laboratory Test Directory on the ARUP Web site at www.aruplab.com.

Test Name and Number	Recommended Use	Limitations	Follow Up
Albumin, Serum or Plasma by Spectrophotometry 0020030 Method: Spectrophotometry	Evaluate production of albumin by liver; assess nutritional status Assess nephrotic syndrome and protein-losing enteropathy	Albumin may be acutely decreased in sepsis or trauma	
Prealbumin, Serum 0050435 Method: Immunoturbidimetric	Assess nutritional status in premature infants, in cancer patients and surgical patients Recommended protein measurement to evaluate nutritional status in hospitalized patients Assess nephrotic syndrome and protein-losing enteropathy	Prealbumin may be acutely decreased in sepsis, trauma	
Retinol Binding Protein 0050467 Method: Nephelometry	Indicate early malnutrition, acute and chronic hepatic disease, advanced chronic renal insufficiency and cystic fibrosis Assess nephrotic syndrome and protein-losing enteropathy		
Transferrin, Serum 0050570 Method: Immunoturbidimetric	Aid in differential diagnosis of malnutrition Monitor iron deficiency anemia		
Alpha-1-Antitrypsin, Feces 0099991 Method: Radial Immunodiffusion	Order as a follow-up test when protein-losing enteropathy is suspected Serves as a clearance measure; calculations require that serum alpha-1-antitrypsin test also be ordered	Blood in stool or diarrhea may increase clearance	

Alpha-1-Antitrypsin 0050001 Method: Immunoturbidimetric	Calculations for the alpha-1-antitrypsin fecal test require that this test also be ordered		
---	--	--	--

General References

Danziger J. Importance of low-grade albuminuria. *Mayo Clin Proc.* 2008; 83 (7) :806-812.

Delville CL. Are your patients at nutritional risk?. *Nurse Pract.* 2008; 33 (2) :36-39.

Ellegard LH, Bosaeus IG. Biochemical indices to evaluate nutritional support for malignant disease. *Clin Chim Acta.* 2008; 390 (1-2) :23-27.

Kmiec Z. Cooperation of liver cells in health and disease. *Adv Anat Embryol Cell Biol.* 2001; 161 :III-151.

Noy N. Retinoid-binding proteins: mediators of retinoid action. *Biochem J.* 2000; 348 Pt 3 :481-495.

Pencharz PB. Assessment of protein nutritional status in children. *Pediatr Blood Cancer.* 2008; 50 (2 Suppl) :445-446.

Perez Valdivieso Jr, Bes-Rastrollo M, Monedero P, de Irala J, Lavilla FJ. Impact of prealbumin levels on mortality in patients with acute kidney injury: an observational cohort study. *J Ren Nutr.* 2008; 18 (3) :262-268.

Veldee MS. Nutritional Assessment, Therapy, and Monitoring. In Burtis CA and Ashwood ER, ed. *ietz Fundamentals of Clinical Chemistry*, 5th ed. Philadelphia: W.B. Saunders, 2001. pp. 936-954.

Reviewed by

Delgado, Julio C., MD, MS. Medical Director, Protein Immunology at ARUP Laboratories; Associate Director, Histocompatibility and Immunogenetics Laboratory and Assistant Professor of Pathology, University of Utah

Roberts, William L., MD, PhD. Medical Director, Automated Core Laboratory at ARUP Laboratories; Professor of Pathology, University of Utah

Related Content

- Acute Phase Inflammatory Proteins - Acute Phase Reactants
- Malabsorption
- Wilson Disease

Comprehensive Review: November 2009
 Last Update: November 2009