Malnutrition and Refeeding Syndrome in the Hospital Setting

Definition and Epidemiology

- Malnutrition is a state of nutritional deficiency or imbalance, characterized by inadequate intake of calories, protein, or micronutrients, leading to weight loss, muscle wasting, and impaired organ function. Refeeding syndrome is a potentially fatal complication of nutritional repletion in malnourished patients, marked by electrolyte shifts, fluid imbalances, and metabolic disturbances.
- Prevalence Malnutrition affects ~20-50% of hospitalized patients, with higher rates in ICU (50-70%) and elderly (>60%). Refeeding syndrome occurs in 10-25% of severely malnourished patients during refeeding.
- Risk Factors Anorexia nervosa, cancer cachexia, chronic alcoholism, prolonged fasting, GI disorders (e.g., Crohn's).
- Rare Demographics Pediatric malnutrition (kwashiorkor, marasmus), post-bariatric surgery, rare genetic disorders (e.g., mitochondrial diseases).

Pathophysiology

- Mechanisms Malnutrition depletes glycogen, fat, and protein stores, shifting metabolism to catabolism, reducing insulin, and increasing glucagon/cortisol. Refeeding introduces carbohydrates, spiking insulin, driving electrolytes (K+, Mg2+, PO4-) intracellularly, causing hypophosphatemia, hypokalemia, and fluid shifts.
- Effects Malnutrition impairs immune function, wound healing, and muscle strength, increasing infection and mortality risk. Refeeding syndrome causes cardiac arrhythmias, respiratory failure, and cerebral edema due to rapid metabolic changes.
- Molecular Pathways In malnutrition, mTOR signaling is downregulated, halting protein synthesis. Refeeding activates PI3K-Akt, shifting phosphate into cells for ATP/glycolysis, depleting serum levels. Thiamine deficiency exacerbates lactate accumulation.
- Key Pathway Malnutrition → Catabolic state → Glycogen/protein depletion; Refeeding → Insulin surge → Electrolyte shifts → Metabolic and cardiac complications.

Causes

Category	Common Causes	Rare Causes	Notes
Starvation	Anorexia nervosa, poverty	Prolonged fasting (religious), neglect	Severe weight loss (>10% in 3 months)
Chronic Disease	Cancer cachexia, COPD	Amyloidosis, mitochondrial disorders	Cytokine-driven (IL-6, TNF-α)
GI Disorders	Crohn's, short bowel syndrome	Celiac crisis, Whipple's disease	Malabsorption reduces nutrient uptake
Substance Abuse	Alcoholism, IVDU	Methamphetamine (anorexia)	Alcoholics at high refeeding risk
Iatrogenic	Prolonged NPO, TPN cessation	Post-bariatric surgery	NPO >7 days increases risk
Psychosocial	Depression, dementia	Factitious disorder	Elderly with dementia often malnourished

Clinical Presentation

Symptoms

- Weight loss, fatigue, weakness
- Loss of appetite, cold intolerance
- Edema (kwashiorkor), seizures (refeeding)
- Rare Hypoglycemia, hallucinations (micronutrient deficiency)

Exam

- Muscle wasting, temporal atrophy
- Edema (protein deficiency), dry skin, hair loss
- Tachycardia, arrhythmias (refeeding)
- Rare Ascites (kwashiorkor), peripheral neuropathy (B1/B12 deficiency)
- Red Flags BMI <16 kg/m^2, phosphate <1.5 mg/dL, K+ <2.5 mEq/L, AMS

Labs and Studies

Labs

- Prealbumin <15 mg/dL (malnutrition severity), albumin <3 g/dL (chronic)
- Electrolytes Hypophosphatemia (<2.5 mg/dL), hypokalemia (<3.5 mEq/L), hypomagnesemia (<1.8 mg/dL)
- CBC Anemia (iron, B12 deficiency), lymphopenia (immune suppression)

- Advanced Thiamine (B1) levels, zinc, selenium, metabolomics (amino acid profiles)

Imaging

- DEXA Scan Sarcopenia, bone density loss
- Abdominal CT Visceral fat loss, ascites (kwashiorkor)
- CXR Cardiomegaly (wet beriberi, B1 deficiency)
- Advanced Whole-body MRI (muscle mass), bioimpedance analysis (body composition)

Other

- ECG Prolonged QT, arrhythmias (refeeding)
- Nutritional Assessment MUST score, SGA (Subjective Global Assessment)
- Advanced Indirect calorimetry (REE), muscle biopsy (mitochondrial disorders)

Diagnosis

- Criteria Malnutrition BMI <18.5 kg/m^2, unintentional weight loss (>5% in 1 month or >10% in 3 months), or reduced intake + muscle loss. Refeeding syndrome Hypophosphatemia (<2.5 mg/dL) within 72h of refeeding + clinical symptoms (arrhythmias, edema).
- Differential Cachexia (disease-driven), sarcopenia (age-related), starvation (intentional), marasmus/kwashiorkor.

Flowsheet

- Step 1 History/Exam Weight loss, dietary history, muscle wasting; assess refeeding risk
- Step 2 Labs Prealbumin, electrolytes, thiamine; rule out infection (CRP, cultures)
- Step 3 Nutritional Assessment MUST/SGA score, BMI, dietary recall
- Step 4 Imaging DEXA/CT for muscle/fat loss; ECG for refeeding risk
- Step 5 Monitor Refeeding Start low calories, check electrolytes q12h

Treatment

General Principles Correct malnutrition gradually, prevent refeeding syndrome, and address underlying causes.

Supportive Care

- Thiamine 100 mg IV daily x 3 days before refeeding (prevents Wernicke's)
- Electrolyte Replacement PO/IV K+, Mg2+, PO4- (target PO4- >2.5 mg/dL)
- Fluid Management NS 1-2 L/day, avoid overhydration (edema risk)

Specific Therapies

- Refeeding Start at 10-15 kcal/kg/day (e.g., 500-1000 kcal/day), advance 200-300 kcal/day over 5-7 days
- Enteral Nutrition Preferred (NG tube, peptide-based formula), TPN if GI failure
- Micronutrients Multivitamin, zinc 15 mg/day, vitamin D 1000 IU/day
- Advanced High-protein (1.5-2 g/kg/day), omega-3 supplements (cachexia), anamorelin (cancer anorexia)
- Rare Causes Celiac (gluten-free diet), mitochondrial (coenzyme Q10), bariatric (vitamin A, copper)

Management of Complications

- Arrhythmias Magnesium 2 g IV, potassium 40 mEq IV (central line)
- Edema Furosemide 20 mg IV, albumin 25 g IV (if <2 g/dL)
- Seizures Levetiracetam 500 mg IV q12h, thiamine 500 mg IV

Monitoring

- Daily electrolytes (K+, Mg2+, PO4-) x 5 days during refeeding
- Weekly weight, prealbumin, MUST score
- ECG q24h if QT prolongation or arrhythmias

Complications

Acute

- Refeeding Syndrome Hypophosphatemia, arrhythmias, cerebral edema (10-25% risk)
- Wernicke's Encephalopathy Confusion, ataxia, ophthalmoplegia (B1 deficiency)
- Cardiac Failure Wet beriberi, refeeding edema

Long-Term

- Osteoporosis Bone density loss, fractures (20-30% of chronic malnutrition)

- Immune Suppression Opportunistic infections (TB, Candida)
- Rare Refeeding pancreatitis, rhabdomyolysis, post-malnutrition growth stunting

Clinical Scenarios

Case 1 Anorexia Nervosa with Refeeding

- Presentation 20 y/o F with anorexia nervosa (BMI 15 kg/m^2) admitted for weakness, bradycardia. Vitals BP 90/60, HR 50, SpO2 96%, RR 14. Exam Muscle wasting, lanugo hair.
- Labs/Studies PO4- 1.8 mg/dL, K+ 3.0 mEq/L, prealbumin 10 mg/dL, ECG QTc 480 ms.
- Interpretation Severe malnutrition, high refeeding risk.
- Management Thiamine 100 mg IV x 3 days, start 500 kcal/day (enteral), PO4- replacement (20 mmol IV). Monitor electrolytes q12h. Advance to 1200 kcal by day 7. Psych consult. Stable by day 10.

Case 2 Cancer Cachexia

- Presentation 65 y/o M with lung cancer, 15% weight loss in 3 months, fatigue. Vitals BP 110/70, HR 90, SpO2 94%, RR 16. Exam Temporal wasting, no edema.
- Labs/Studies Albumin 2.5 g/dL, CRP 20 mg/L, zinc 50 mcg/dL. DEXA Sarcopenia.
- Interpretation Malnutrition, cancer cachexia.
- Management High-protein diet (1.5 g/kg/day), omega-3 2 g/day, multivitamin. NG feeding started. Oncology consult for anamorelin trial. Weight gain 1 kg by week 2.

Case 3 Kwashiorkor (Rare)

- Presentation 30 y/o F with alcoholism, edema, and lethargy after 2 weeks NPO. Vitals BP 100/60, HR 100, SpO2 96%, RR 18. Exam Ascites, pitting edema, dermatitis.
- Labs/Studies Albumin 1.8 g/dL, K+ 2.8 mEq/L, thiamine low. CT Ascites, no cirrhosis.
- Interpretation Kwashiorkor, alcohol-related malnutrition.
- Management Thiamine 200 mg IV x 3 days, 600 kcal/day (enteral), albumin 25 g IV. K+, PO4- replacement. Addiction counseling. Edema resolves by day 7.

Expert Tips

- Start thiamine before any calories; 100 mg IV prevents Wernicke's in alcoholics
- Monitor phosphate q12h first 3 days; hypophosphatemia is hallmark of refeeding
- Use enteral over TPN unless GI failure; reduces infection risk
- Assess frailty (gait speed, grip) in elderly; predicts refeeding tolerance
- Consider kwashiorkor in adults with edema, low albumin; not just pediatric
- Pitfall Overfeeding early; start at 10 kcal/kg/day to avoid refeeding syndrome
- Advanced Indirect calorimetry for precise caloric needs; metabolomics to guide micronutrient therapy

Key Pearls

- Malnutrition diagnosis requires BMI <18.5 or >10% weight loss + muscle wasting
- Refeeding syndrome risks hypophosphatemia, arrhythmias; start low (500-1000 kcal/day)
- Thiamine 100 mg IV is mandatory before refeeding in high-risk patients
- Enteral nutrition is preferred; TPN only for GI failure
- Rare kwashiorkor in adults (alcoholism) presents with edema, dermatitis

References

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