Complications of Total Parenteral Nutrition

Total Parenteral Nutrition (TPN) refers to the intravenous administration of nutrients to meet the body's metabolic demands when oral or enteral nutrition is contraindicated, insufficient, or impossible.

> **Key Point:** TPN bypasses the gastrointestinal (GI) tract entirely and is delivered via a central venous catheter.

Types of Parenteral Nutrition

1. **Partial Parenteral Nutrition (PPN):**
   - Provides a portion of nutritional needs.
   - Administered via a **peripheral vein** .
   - Used short-term, often includes dextrose and amino acids.
2. **Total Parenteral Nutrition (TPN):**
   - Provides **complete nutritional support** (macronutrients, micronutrients, electrolytes, vitamins, trace elements).
   - Requires a **central venous access** (e.g., subclavian or internal jugular vein) due to osmolarity.
   - Used in **long-term or critical care** situations.

Indications for TPN

- GI tract non-functional or inaccessible (e.g., bowel obstruction, fistulas).
- Severe malabsorption (e.g., short bowel syndrome).
- Severe pancreatitis, paralytic ileus.
- Intractable vomiting or diarrhea.
- Critical illness with high metabolic demand and poor enteral tolerance.

Complications of TPN

1. Mechanical Complications

These arise from **central venous catheter (CVC) insertion and maintenance** :

- **Pneumothorax, Hemothorax** – due to vascular or pleural injury.
- **Brachial plexus injury.**
- **Malpositioning** of catheter (e.g., into azygos vein, right atrium).
- **Catheter-related thrombosis** – can extend into central veins.
- **Catheter embolization** – due to disconnection or fracture.
- **Line dislodgement, leakage, or blockage.**

> **Prevention:** Use of ultrasound-guided insertion, chest X-ray to confirm position, aseptic

technique.

2. Metabolic Complications

a. Early Metabolic Complications:

- **Fluid overload** ? congestive heart failure, especially in elderly.
- **Electrolyte shifts** (hypokalemia, hypophosphatemia) due to:
  - Refeeding syndrome in cachectic patients.
  - Intracellular shifts due to insulin spike from glucose infusion.
- **Hyperglycemia or osmotic diuresis.**
- **Azotemia and elevated BUN** ? suggest dehydration.

Management: Initiate TPN slowly, monitor electrolytes, and adjust formulation gradually.

b. Late Metabolic Complications:

- **Hepatic dysfunction:**
  - **Cholestasis** , hepatic steatosis, bile sludging.
  - May progress to fibrosis or cirrhosis.
  - **Gallbladder stasis** ? cholelithiasis or cholecystitis.

    Associated with lack of enteral stimulation, high glucose infusion, and sulfur amino acid imbalances.

- **Bone demineralization (osteopenia):**
  - Due to **hypercalciuria** (acidic amino acid load, bisulfite preservative).
  - Aluminum contamination (from additives like calcium gluconate) impairs bone mineralization.
- **Micronutrient deficiencies:** Especially of:
  - **Essential fatty acids** .
  - **Zinc, copper, selenium** , and **fat-soluble vitamins** (A, D, E, K).

    Solution: Add complete micronutrient formulations to TPN.

3. Infectious Complications

- **Catheter-related bloodstream infections (CRBSI)** are serious concerns.
  - Most common organisms: *Staphylococcus aureus, Candida spp.*
  - Infection suspected if fever resolves upon discontinuation of TPN.
  - **Positive central line cultures** confirm diagnosis.

Risk factors: Multiple-lumen catheters, poor hygiene, long dwell times.

Prevention:

- Single-lumen catheters dedicated to TPN.
- Use of antiseptic-impregnated cuffs.
- Heparin and/or antibiotic lock solutions (in select patients).

Treatment: Empiric antibiotics for bacterial infections. Removal of catheter + antifungals for Candida.

4. Gallbladder Complications

- **Gallstones and cholecystitis** occur due to **biliary stasis** .
    - Worsened by prolonged fasting and absence of enteral intake.

Prevention & Treatment:

- Provide **20–30% of total calories as lipids** .
- **Cycle TPN infusion** (pause several hours/day).
- **Stimulate bile flow** using:
    - Enteral nutrition.
    - **Ursodeoxycholic acid, cholecystokinin, metronidazole, phenobarbital** (case-dependent).

Monitoring TPN

Regular assessment is vital:

- **Daily labs:** Electrolytes, BUN, creatinine, glucose.
- **Weekly labs:** LFTs, triglycerides, micronutrients.
- **Weight, input/output, signs of fluid overload** .
- **Bone mineral density (long-term use)** .

Risk Factors Requiring TPN

- Severe **malnutrition or cachexia** .
- Postoperative GI rest > 5–7 days.
- Intestinal obstruction, trauma, or ischemia.
- Severe **pancreatitis** .
- **Inflammatory bowel disease** unresponsive to enteral nutrition.
- **Short bowel syndrome** or high-output fistula.

High-Yield Note

Complication Type	Examples	Prevention/Management
Mechanical	Pneumothorax, thrombosis	Aseptic technique, imaging confirmation
Metabolic	Electrolyte shifts, hepatic	Slow initiation, lab monitoring

Complication Type	Examples	Prevention/Management
	dysfunction	
Infectious	Catheter sepsis	Dedicated lines, strict hygiene
Hepatobiliary	Cholestasis, gallstones	Provide some enteral intake, lipid calories
Bone & Nutrients	Osteopenia, deficiencies	Supplement micronutrients, monitor calcium