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SYSTEMATIC REVIEW ON THE TOTAL PARENTRAL NUTRITION

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ABSTRACT

Total Parenteral Nutrition (TPN) is a medical therapy that provides nutrition intravenously, bypassing the digestive system. It delivers a combination of carbohydrates, proteins, fats, vitamins, and minerals directly into the bloodstream. TPN is typically used for patients who cannot eat or absorb nutrients through their gastrointestinal tract, such as those with gastrointestinal disorders, severe malnutrition, or post-surgery recovery. This method ensures that patients receive essential nutrients to maintain their health and support recovery. TPN requires careful monitoring to prevent complications like infections, electrolyte imbalances, and liver dysfunction.

KEYWORDS: **Definition, Purposes, Indication, Side effects, Procedure, Nursing Care Plan,**

INTRODUCTION

One type of feeding that avoids the gastrointestinal system is called total parenteral nutrition, or TPN. The majority of the nutrients the body requires are supplied via fluids injected into a vein. When a person is incapable of receiving food or liquids via mouth, this approach is utilized.

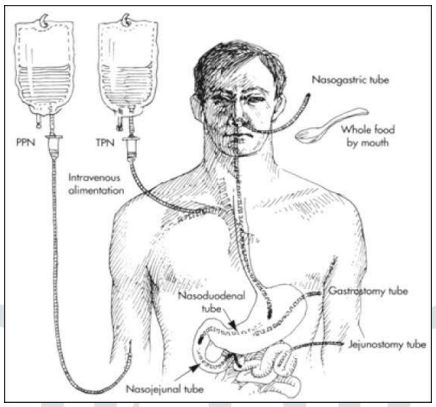
DEFINITION

Intravenous administration of varying combinations of hypertonic or isotonic glucose, lipids, amino acid, electrolytes, vitamins, and trace elements through a venous access device (VAD) directly into the intravascular

fluid to provide nutrients for patients who are unable to receive adequate nutrition through the gastrointestinal tract.

PURPOSES

- For those who are unable to swallow food, to avoid the GI tract.
- To supply the nutrients needed for a healthy metabolism, tissue upkeep, repair, and energy requirements.



A healthcare professional can choose the approach that best fits the patient from three options for starting complete parenteral solution administration. The three techniques are

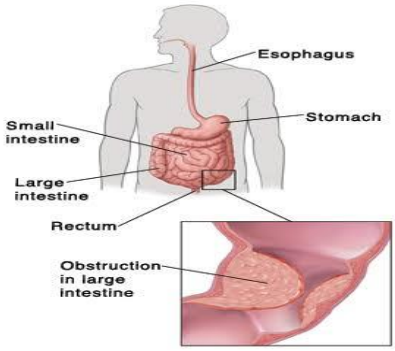
- **Peripheral** – The peripheral vein is used to administer the less hypertonic TPN solution.
- **Atrial** – External right atrial catheters can be surgically inserted with a single or double lumen; the subcutaneous port can also be used for infusion.
- **Central** – The subclavian vein is the most common site for catheter implantation because of its stability and area of use for moderate-to-long-term intravenous therapy.

INDICATION

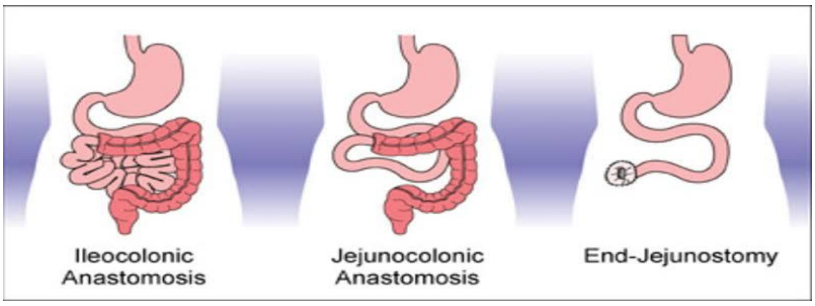
Gastrointestinal disorders

For individuals with illnesses requiring total bowel rest or without a functional gastrointestinal system, TPN may be the only practical means of supplying nourishment.

Bowel obstruction

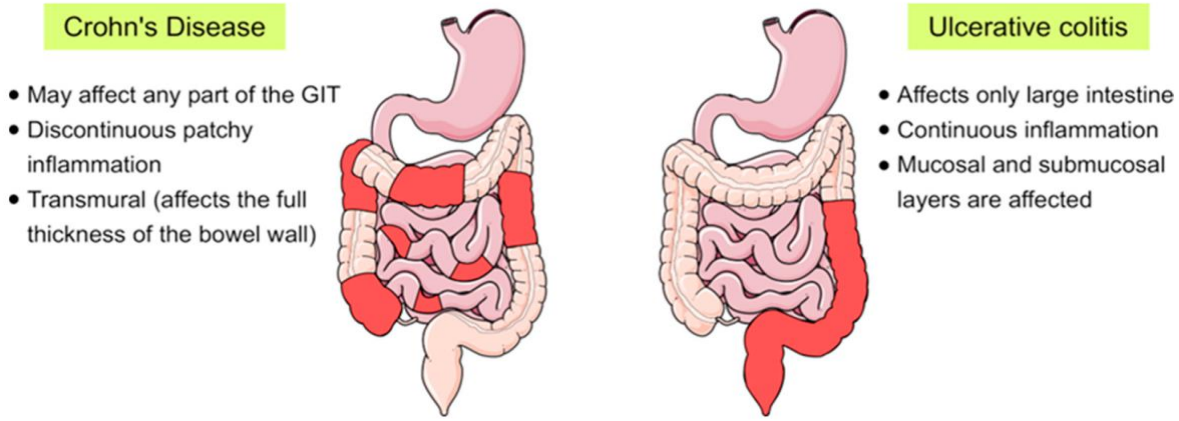


SHORT BOWEL SYNDROME



GASTROSCHISIS

VERY SEVERE CROHN'S DISEASE OR ULCERATIVE COLITIS



In geriatric population

The elderly population has unique physical, physiological, and mental characteristics that may result in inadequate food intake, necessitating nutrition therapy. Parenteral nutrition is a suitable option for patients who need nutrition therapy but cannot tolerate enteral feeding or have contraindications to it.

In cancer

Malnutrition is a risk factor for patients with cancer diagnoses. A decrease in food intake, an increase in energy needs, and changes in metabolism are all linked to malnutrition associated with cancer.

During the early stages of cancer treatment, patients should have their nutritional risk evaluated. This can be done by regularly measuring their weight and BMI.

A digestive tract cancer may clog the intestines, making it difficult to consume enough food. Chemotherapy and other cancer treatments can make it difficult for your body to absorb nutrition.

What the solution contains:

The patient's age, weight, height, and medical condition are taken into consideration while determining the ingredients of the TPN solution. All solutions include protein (amino acids) and sugar (dextrose) for energy. Lipids, or fats, can also be added to the mixture. Other electrolytes that are necessary for the body to operate normally are potassium, sodium, calcium, magnesium, chloride, and phosphate. Additionally required are trace elements like copper, manganese, zinc, and chromium. Insulin, a hormone that aids in the body's use of sugar, and vitamins can both be given to the TPN solution.

Basic Adult Daily Requirements for Total Parenteral Nutrition

Nutrient	Amount
Water (/kg body wt/day)	30–40 mL
Energy* (/kg body wt/day)	
Medical patient	30-35 kcal
Postoperative patient	30–45 kcal
Hypercatabolic patient	45 kcal
Amino acids (/kg body wt/day)	
Medical patient	1.0 g
Postoperative patient	2.0 g
Hypercatabolic patient	3.0 g
Minerals	
Acetate/gluconate	90 mEq
Calcium	15 mEq
Chloride	130 mEq
Chromium	15 mcg
Copper	1.5 mg
Iodine	120 mcg
Magnesium	20 mEq
Manganese	2 mg

Nutrient	Amount
Phosphorus	300 mg
Potassium	100 mEq
Selenium	100 mcg
Sodium	100 mEq
Zinc	5 mg
Vitamins	
Ascorbic acid	100 mg
Biotin	60 mcg
Cobalamin	5 mcg
Folate (folic acid)	400 mcg
Niacin	40 mg
Pantothenic acid	15 mg
Pyridoxine	4 mg
Riboflavin	3.6 mg
Thiamin	3 mg
Vitamin A	4000 IU
Vitamin D	400 IU
Vitamin E	15 mg
Vitamin K	200 mcg
*Requirements for energy increase by 12% per 1° C of fever.	

Identifying the Side Effects and Adverse Events Related to TPN and Intervening as Appropriate

Complications associated with the insertion of the TPN catheter

Some of the complications associated with the insertion of the **TPN** catheter include accidental and inadvertent

- **Pneumothorax**
- **hemothorax or hydrothorax**

When the TPN catheter perforates the **vein** and fluid enters the **pleural space**.

The **signs and symptoms** of these insertion complications include

- **Chest pain**
- **Shortness of breath and pain.**

Infection

Infection is probably the most commonly occurring complication associated with total parenteral nutrition.

This complication can be prevented by using a strict sterile technique during its insertion, care, and maintenance.

Most sources of infectious **pathogens enter** this closed system during

- **Insertion,**
- **Tubing changes,**
- **Dressing changes**,
- And when total parenteral nutrition **solutions are mixed.**

The signs and symptoms of these infections include

- **Fever,**
- **Malaise**,
- **Swelling** and redness at the insertion site,
- **Diaphoresis,**
- **Chilling a**nd pain

In the **area of** the TPN catheter **insertion site.**

Fluid overload

Fluid overload can occur when the rate is too fast and rapid for the client.

The signs and symptoms of fluid overload include

- **hypertension,**
- **edema,**
- **adventitious breath sounds like crackles and rales,**
- **shortness of breath,**
- and **bulging neck veins**

This complication can be prevented

- by **monitoring the client**
- and **adjusting the rate** of the total parenteral nutrition

To prevent fluid overload.

Hyperglycemia

Hyperglycemia can occur because of

- The **high dextrose content** in the total parenteral nutrition solution
- The **lack of a sufficient amount of insulin administered** in TPN

The signs and symptoms of hyperglycemia secondary to total parenteral nutrition are the same as those associated with poorly managed diabetes and they include

- A **high blood glucose level,**
- **Thirst,**
- **Excessive urinary output,**
- **Headache,**
- **Nausea and fatigue.**

Complication can be prevented with the **continuous monitoring** of the client's **blood glucose levels.**

Hypoglycemia

Hypoglycemia secondary to total parenteral nutrition are the same as those associated with poorly managed diabetes and it includes:-

- **Headache,**
- **Low blood glucose level,**
- **Shakiness,**
- **Clammy and cool skin,**
- **Blurry vision,**
- **Diaphoresis**
- **Unconsciousness and seizures.**

This **complication** of total parenteral nutrition, like hyperglycemia, can be prevented with:-

- The close monitoring of the client's blood glucose levels
- An adequate dosage of insulin is based on these levels.

Embolism

Embolism can occur when air is permitted to enter this closed system during tubing changes and when a new bottle or bag of hyperalimentation is hung.

This complication can be prevented by

- Instructing the client to perform the Valsalva maneuver. [The Valsalva maneuver involves trying to exhale against a closed airway with a modest amount of power. This is typically accomplished by closing one's mouth, pinching shut their nose, and then exhaling as though blowing up a balloon.]
- And the nurse's rapid changing of tubing and solutions when the closed system is opened to the air.

The signs and symptoms of an embolism include

- dyspnea,
- Shortness of breath,
- Coughing,
- Chest pain
- And respiratory distress.

PROCEDURE OF TPN

S.NO	NURSING ACTION	RATIONALE
1	Assess the need for parentral nutrition by performing nutritional assessment	Provides baseline data to compare changes the parentral nutrition is started
2	Check physicians order for method of parentral nutrition (TNA,TPN, or lipids) and flow rate.	Parentral therapy must be ordered by physician
3	Explain the procedure in detail to the patient and relatives.	
4	Obtain informed consent	
5	Collect needed equipment for the procedure	
6	Remove the bag of parentral nutrition from refrigerator at least 1 hour before procedure (if refrigerated).	Decreases incidence of hypothermia, pain and vasospasm.
7	Inspect fluid for presence of cracking or creaming or any change in constitution. If present, discard and check for expiry date. confirm with order	Indicates fluid separation. TPN solution should be clear without clouding
8	Wash hands don cap, mask, gown and sterile gloves.	Follows very strict aseptic precautions
9	Using strict aseptic technique, attach tubing (with filter) to TNA bag and purge out air.	Prevents chances of developing air embolus
10	Close all clamps on new tubing and insert tubing into volume control infuser.	Close all clamps on new tubing and insert tubing into volume infuser
11	Place the patient in supine position and turn head away from VAD insertion site.	Supine position opens the angle between calvicle and first rib and turning head away from site will decrease possible microbial contamination of site
12	Clean the insertion site with alcohol and povidone iodine solution.	Clean the insertion site with alcohol and povidone iodine solution
13	Assist the physician while inserting VAD	
14	After insertion of VAD, connect tubing to hub of VAD using sterile technique and make sure that the connection is secured using luer-lock connection.	
15	Open all clamps and regulate flow through volume control infuser.	Open all clamps and regulate flow through volume control infuser.
16	Monitor administration hourly, assessing for integrity of fluid and administration system and patient tolerance	
17	Record the procedure	

NURSING CARE PLAN

NURSING DIANOSIS

- Imbalanced Nutrition: Less Than Body Requirements
- Risk for Excess Fluid Volume
- Risk for Deficient Fluid Volume

- Risk for Altered Body Composition

Imbalanced Nutrition: Less than Body Requirements

Desired Outcomes

The client will reach a sufficient nutritional state, as demonstrated by better albumin levels and stable weight or weight gain.

Nursing Interventions	Rationale
Assess skin integrity and wound healing.	TPN therapy effectiveness is tracked using changes in skin integrity and wound healing as metrics.
Measure intake and output accurately; Monitor weight daily; Monitor calorie counts, including calories provided by TPN.	The client's estimated nutritional requirements serve as the basis for the TPN composition. Health care professionals, including doctors, nurses, dieticians, and pharmacists, will conduct a comprehensive baseline examination prior to the initiation of therapy. TPN efficacy is measured by changes in weight, calorie consumption, and fluid balance. We weigh ourselves every day to see if our nutritional objectives are being reached. The fluid volume status is also evaluated using weight. Gaining more than half a pound of weight every day could be a sign of fluid retention.
Assist with the insertion and maintenance of central venous or peripherally inserted central catheters (PICC).	TPN solution is injected into the vascular system using a catheter that is placed into a central vein with a large blood flow volume because of its high osmolality. Typically, the superior vena cava is where the catheter tip is inserted. Before starting TPN therapy, a proper catheter placement can only be confirmed by X-ray. Until the insertion is established, the central catheter may be used to inject normal saline or other isotonic fluids.
Encouraged additional oral fluid intake as indicated.	To optimize nutritional assistance, a client on TPN may receive more oral fluids. Oral consumption may be psychologically beneficial for clients, particularly when meals are shared with family.
Administer the prescribed rate of TPN solution via an infusion pump.	Throughout the therapy, electronic infusion pumps are employed to maintain a precise rate of dosage. If TPN is administered too quickly, the patient may not receive the necessary nourishment; on the other hand, if TPN is administered too soon, there is a risk of a hyperglycemic crisis since the hormone insulin may not be available to support the higher glucose load.
Collaborate with other nutritional support team, dietician, pharmacy, home health nurse.	When parenteral nourishment is administered under the guidance of a skilled nutritional support team, the likelihood of most hospital problems is reduced.

Risk for Excess Fluid Volume

Desired Outcomes

The client will continue to maintain a regular fluid volume, as shown by a balanced intake and output, no edema, and no significant weight gain.

Nursing Interventions	Rationale
Assess for the following signs and symptoms of excess fluid volume:	
• **Shortness of breath; Crackles upon auscultation.**	The buildup of fluid in the lungs is the source of these respiratory alterations.
• **Edema**	Edema occurs when fluid accumulates in the extravascular spaces. Edema usually begins in the fingers, facial area, and presacral area. Generalized edema, called anasarca, occurs later and involves the entire body. A weight gain of more than half a pound per day is an indication of fluid volume excess.
• **Distention of jugular veins**	The initial sign of elevated central venous pressure is jugular vein distention.
Monitor laboratory studies such as serum sodium levels.	Because hypernatremia retains fluid in the extravascular spaces, it can either cause or worsen edema.
Place the client in a semi-Fowler's or high-Fowler's position.	Maintaining the head of the bed elevated will promote ease in breathing. This position also allows the pooling of fluid in the bases and for gas exchange to be more available to the lung tissue.
Handle with caution on extremities with edema.	Edematous skin is more prone to damage and breakdown.
Administer diuretics such as furosemide (Lasix) as indicated.	Diuretics encourage fluid excretion.

Risk for Deficient Fluid Volume

Desired Outcomes

The patient will be normovolemic if their heart rate is between 60 and 90 beats per minute, their systolic blood pressure is 90 mm Hg or higher, they do not have orthostasis, they produce at least 30 ml of urine per hour, and their skin turgor is normal.

Nursing Interventions	Rationale
Assess for the signs and symptoms of deficient fluid volume:	
• **Skin integrity**	Reduced fluid volume causes the skin to become dry and have low turgor.
• **Tachycardia**	When there is a fluid volume shortage, the heart rate increases in compensation.
• **Hypotension**	A shortfall in fluid volume lowers blood pressure by reducing

	circulatory volume.
• **High urine specific gravity**	Urine becomes more concentrated with a decrease in fluid volume.
Assess urine output hourly.	Urine output consistently below fluid intake signifies a fluid volume deficit and the need for additional fluid to prevent dehydration.
Monitor laboratory studies as indicated:	
• **Serum protein levels.**	Protein levels are often checked every three to seven days. Low blood protein levels can cause low colloidal pressures, which can result in fluid loss from intravascular regions.
• **Blood sugar levels.**	Hyperglycemia, caused by infusion of a high concentration of glucose in the TPN solution, can lead to hyperosmolar, nonketotic coma with subsequent dehydration secondary to osmotic diuresis.
Encourage an additional oral fluid intake unless contraindicated. Administer maintenance or bolus fluids as prescribed, in addition to TPN.	Additional fluids may be needed for NPO clients who are only receiving TPN because it's possible that they aren't getting enough fluids, especially because TPN is started at modest administration rates.
Weigh client daily during the first week of the administration of TPN then weekly thereafter.	We need to weigh ourselves every day to see if we are meeting our nutritional targets. The fluid volume status is also evaluated using weight. More than half a pound of weight loss per day could be a sign of a fluid volume deficiency.
Administer TPN at the ordered rate; if the infusion is interrupted, infuse 10% dextrose in water until the TPN infusion is restarted.	In addition to giving the client the necessary fluids, this replacement infusion guards against abrupt hypoglycemia, which can happen when a high glucose concentration to which the client has been acclimated is abruptly removed.

Risk for Altered Body Composition

Desired Outcomes

The client will continue to have normal serum electrolyte values and blood glucose levels.

Nursing Interventions	Rationale
Assess for signs and symptoms of vitamin deficiency:	
• Dry, scaly skin	This change links to Vitamin D and E deficiencies.
• Easily bruised and thrombocytopenia	These findings are caused by coagulopathy secondary to inadequate vitamin K levels.
• Poor wound healing	This change relates to Vitamin A and E deficiencies.
Assess for signs and symptoms of electrolyte imbalances:	
• Hypokalemia	Changes in the level of consciousness such as confusion and lethargy; muscle weakness; ST-segment depression, U-wave, and ventricular dysrhythmias.
• Hyponatremia	Changes in the level of consciousness such as confusion and lethargy; Nausea, vomiting, muscle weakness, tremors, and seizures.
• Hypophosphatemia	Changes in the level of consciousness, and muscle weakness.
• Hypocalcemia	Paresthesia, tetany, seizures, positive Chvostek's sign, irregular heart

	rate.
• Hypomagnesemia	Muscle weakness, cramping, twitching, tetany, seizures, irregular heart rate.
Assess blood glucose levels for signs and symptoms of:	
• Hypoglycemia	Signs of hypoglycemia such as clammy skin, agitation, weakness, and tremors are most likely to be seen when TPN infusion rates are decreased or the infusion is stopped.
• Hyperglycemia	Signs of hyperglycemia such as such as thirst, polyuria, confusion, and glycosuria are most likely to be seen on initiation of TPN.
Assess for signs and symptoms of fat embolism.	Clients who are receiving fat emulsions are prone to fat embolism (headache, cyanosis, skin flushing, and dyspnea) which is rare but serious complication of the infusion.
Monitor serum triglyceride levels.	Clients receiving an IV fat emulsion should have their triglyceride monitored any time changes are made in the amount of fat administered.
Administer electrolyte replacement therapy as indicated.	Electrolytes are supplied based on the client's calculated need.
Taper off the rate of TPN when discontinuing the therapy.	This measure prevents a hypoglycemic episode caused by abrupt TPN withdrawal.
Do the following when TPN solution stops or must be stopped suddenly:	
• For hyperglycemia, administer insulin as ordered.	This measure facilitates the metabolic use of glucose.
• For a clotted catheter or if subsequent TPN bags are not available, hang 10@ dextrose and water at the rate of the TPN infusion.	This solution provides a higher concentration of glucose to prevent sudden hypoglycemia.
• For emergency or cardiac arrest situations, stop the infusion; administer bolus doses of 50 % dextrose.	These measures prevent hypoglycemia during resuscitation.

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