PROCEDURE

Total parenteral nutrition - infants

Total parenteral nutrition gives an infant nutrients directly into the bloodstream when milk feeding cannot provide enough nutrition.

PURPOSE
Provide complete nutrition when milk feeding is unsafe or insufficient

PROCEDURE TYPE
Therapeutic - bedside intravenous infusion through a central or peripheral line

WHERE IT IS DONE
Neonatal unit bedside; sometimes at home after specialist training

ANAESTHESIA
None for infusion; line placement may use local or general anaesthesia

HOW LONG IT TAKES
Each infusion usually runs 12 to 24 hours

PREPARATION
Blood tests, intravenous access, and an individualized nutrition prescription

RECOVERY
No recovery period; no driving restriction for caregivers

MAIN RISKS
Bloodstream infection, blood clots, metabolic imbalance, liver complications

RESULTS
Nutrition begins immediately; growth and blood tests change over days

Overview

Total parenteral nutrition, or TPN, provides nutrients directly into an infant's bloodstream. It bypasses the stomach and intestines.

TPN contains carefully measured amounts of fluid, glucose, protein, fats, vitamins, minerals, and electrolytes such as sodium and potassium. The exact mixture is prescribed for your baby's weight, age, medical condition, blood results, and other sources of nutrition.

"Total" means the infusion can provide all nutritional needs. Some babies receive partial parenteral nutrition while also having breast milk or formula.

TPN is usually given through a central venous catheter. This is a thin tube whose tip lies in a large vein near the heart. Examples include a peripherally inserted central catheter, known as a

PICC, and an umbilical venous catheter. Short-term, less concentrated nutrition may sometimes be given through a small peripheral IV.

Why the procedure is performed

TPN is used when an infant cannot safely digest or absorb enough milk to support growth and recovery. It can prevent or treat nutritional shortages while the digestive tract develops or heals.

Reasons an infant may need TPN include:

TPN does not treat the underlying bowel or medical condition. It supports the baby until feeding becomes possible or provides longer-term nutrition when the intestine cannot absorb enough.

- Premature birth, especially before the gut is ready for full milk feeds
- Major surgery involving the stomach or intestines
- A bowel condition that makes feeding temporarily unsafe
- A blockage or a period when the intestines are not moving normally
- Short bowel syndrome, meaning too little working intestine remains
- Severe feeding intolerance or poor absorption of nutrients
- A need to restrict milk feeds while still providing nutrition

Who should and should not have it

TPN may be appropriate when the likely benefit of reliable nutrition is greater than the risks of an intravenous line and prolonged infusion. The neonatal team considers the baby's expected feeding progress, growth, fluid needs, blood results, and overall condition.

It is usually not the first choice when the stomach and intestines can safely provide enough nutrition. Feeding through the digestive tract supports normal gut function and avoids central-line risks.

TPN may be delayed, reduced, or reformulated while severe blood sugar, electrolyte, or fluid problems are corrected. A suspected bloodstream infection may require removal or replacement of the catheter rather than stopping nutrition altogether.

A peripheral IV cannot safely carry some highly concentrated TPN mixtures. If suitable central access cannot be obtained, the team may need to use a less concentrated mixture, provide

nutrition by another route, or reconsider the plan.

For an infant with a life-limiting condition, the benefits and burdens of TPN should be considered as part of the family's goals for care.

How to prepare

The treating facility's own instructions take priority because preparation depends on the type of IV line and your baby's condition.

The clinical team will check your baby's weight, fluid balance, blood sugar, electrolytes, kidney function, and liver function. They will also review current milk feeds, medicines, allergies, and previous problems with intravenous lines.

Your baby does not usually need to fast for the TPN infusion itself. Fasting may be required if a central line must be inserted under sedation or general anaesthesia. Do not stop breast milk, formula, or medicines unless the treating team tells you to do so.

If you plan to provide expressed breast milk, ask about pumping, labeling, storage, and transport. Milk feeds can often begin or continue in small amounts while TPN is being given.

What happens during the procedure

First, the team establishes intravenous access. A central line may be inserted through a vein in the arm, leg, neck, chest, or umbilical cord. Ultrasound or X-ray imaging may be used to guide placement or confirm that the tip is in the correct position.

Line insertion is separate from the TPN infusion. Pain relief, sedation, or anaesthesia for insertion depends on the line, the baby's condition, and local practice.

A hospital pharmacy prepares the TPN under sterile conditions. The bag is labeled for your baby and checked before use. A pump delivers it at a controlled rate, often continuously over 24 hours. Fat may be included in the same bag or given separately.

Staff regularly inspect the line and insertion site. They record fluid intake, urine output, weight, blood sugar, and other blood results. The prescription may be changed daily, particularly during the first part of treatment.

Recovery and what to expect afterward

Pain: TPN flowing through a correctly placed line should not hurt. Your baby may have

temporary discomfort, bruising, or tenderness where the line was inserted. New swelling, redness, leaking, or apparent pain around the line needs prompt assessment.

Eating: TPN does not automatically prevent breast milk or formula feeding. When it is safe, small milk feeds are often started and increased gradually. TPN is reduced as the digestive tract provides more nutrition.

Activity: Infants can usually be held, comforted, and given skin-to-skin care when medically stable. Staff will show you how to avoid pulling, bending, or contaminating the line.

Driving: TPN does not affect a parent or caregiver's ability to drive. If your baby goes home on TPN, secure the baby normally in an approved car seat and follow the home nutrition team's instructions for transporting the pump and bags.

Work: There is no standard recovery period. Returning to work depends on your baby's health, discharge plan, appointments, and whether home TPN training is required.

Risks and possible complications

Central-line bloodstream infection is one of the most important risks. Germs can enter through the catheter or its connections. An infection may require antibiotics and sometimes removal of the line.

A blood clot can form around a central catheter. This may cause swelling or problems with the line. Catheters can also move, break, become blocked, leak, or irritate nearby tissue.

Blood sugar and electrolyte levels can become too high or too low. Too much or too little fluid or nutrition may also affect breathing, swelling, growth, or organ function. Regular blood tests and prescription changes reduce these risks.

Longer-term TPN can contribute to liver and bile-flow problems. It may also affect bone mineral health or lead to shortages or excesses of certain nutrients. These concerns are monitored more closely when treatment lasts for weeks or months.

A peripheral IV can leak into surrounding tissue. Concentrated nutrition can damage the skin and tissue, so swelling or color change around the IV requires immediate attention.

Results and follow up

TPN begins supplying nutrients as soon as the infusion starts, but there is no single test showing that it has "worked." The team follows several measures over time.

Blood sugar may be checked soon after starting or changing the infusion. Electrolytes,

triglycerides, liver tests, kidney function, fluid balance, and growth are reviewed over the following days. Testing is usually more frequent at first and may be spaced out once the prescription is stable.

Daily weight can be affected by fluid changes, so the team also considers longer-term weight trends, length, head growth, urine output, and tolerance of milk feeds.

As your baby takes and absorbs more milk, TPN is gradually reduced. The catheter is removed when it is no longer needed. Babies discharged on home TPN require specialist follow-up, blood tests, line care, and delivery of prepared nutrition.

Alternatives

Feeding through the digestive tract is the preferred alternative whenever it is safe. Breast milk or formula can be given by mouth or through a tube into the stomach or intestine. This supports gut function and avoids central-line complications, but it may not provide enough nutrition if the bowel cannot tolerate or absorb feeds.

A feeding tube through the nose or mouth is easier to place than a surgical feeding tube, but it can move and is usually used for shorter periods. A gastrostomy or jejunostomy tube enters the stomach or intestine through the abdomen. It may be more practical for long-term feeding but requires a placement procedure.

Peripheral parenteral nutrition uses a small IV rather than a central line. It avoids central catheter placement, but the mixture must be less concentrated and may not meet all nutritional needs without giving too much fluid.

Glucose-containing IV fluids can provide water and limited energy for a short time. They do not contain enough protein, fat, vitamins, or minerals to replace complete nutrition.

In some conditions, surgery may correct a blockage or other intestinal problem. Surgery addresses the underlying issue but has its own risks and does not always remove the immediate need for TPN.

When to call your healthcare team

While your baby is in hospital, tell a staff member immediately about changes around the line, pump alarms, leaking fluid, or a sudden change in your baby's behavior or breathing.

If your baby receives TPN at home, follow the written emergency plan from the home nutrition team. Contact the team urgently for:

Call emergency services for severe breathing difficulty, blue or grey skin, unresponsiveness, a seizure, uncontrolled bleeding, or a catheter that has broken with significant bleeding. Clamp the catheter if you have been trained to do so.

- Fever at or above the threshold in your baby's care plan
- Redness, warmth, swelling, discharge, or bleeding around the line
- Swelling of the arm, leg, neck, face, or chest
- A damaged, leaking, blocked, or displaced catheter
- A cloudy, damaged, leaking, or incorrectly labeled TPN bag
- Repeated vomiting, unusual sleepiness, poor feeding, or fewer wet diapers
- Pump failure or an infusion that stops unexpectedly

Common questions

Will my baby be asleep?

Not for the TPN infusion itself. Your baby may need pain relief, sedation, or general anaesthesia when a central line is inserted.

Can I drive my baby home?

Yes, if the discharge team says your baby is ready. TPN does not restrict your driving, but home TPN requires training and a safe plan for the pump, line, and supplies.

How painful is it?

The infusion should not be painful. Line insertion can cause brief discomfort, and the team provides suitable pain relief. Pain or swelling during an infusion is not expected.

When will I know if it is working?

Blood tests can show changes within hours or days. Growth and feeding progress are assessed over days to weeks rather than from one measurement.

Can my baby still have breast milk?

Often, yes. Small amounts may be used to help the gut develop even when most nutrition comes from TPN. Whether this is safe depends on why TPN is needed.

How long will my baby need TPN?

Some infants need it for a few days, while others need it for weeks or longer. It continues until milk feeds can safely provide enough fluid, energy, protein, and other nutrients.

Sources

- National Institute for Health and Care Excellence. Neonatal parenteral nutrition . NICE guideline NG154, 2020
- Mihatsch WA, et al. ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition. Clinical Nutrition . 2018;37(6 Part B):2303-2305.
- Worthington P, et al. When is parenteral nutrition appropriate? Journal of Parenteral and Enteral Nutrition . 2017;41(3):324-377.
- Ayers P, et al. ASPEN parenteral nutrition safety consensus recommendations. Journal of Parenteral and Enteral Nutrition . 2014;38(3):296-333.
- Centers for Disease Control and Prevention. Summary of recommendations: Guidelines for the prevention of intravascular catheter-related infections