

RGH Pharmacy E-Bulletin

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A joint initiative of the Patient Services Section and the Drug and Therapeutics Information Service of the Pharmacy Department, Repatriation General Hospital, Daw Park, South Australia. The RGH Pharmacy E-Bulletin is distributed in electronic format on a weekly basis, and aims to present concise, factual information on issues of current interest in therapeutics, drug safety and cost-effective use of medications.

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Total parenteral nutrition

Total Parenteral Nutrition (TPN) is a very complex pharmaceutical formulation, usually including amino acids, dextrose, electrolytes, vitamins, trace elements and water for injection. Where patients are unable to consume adequate fluids and calories to maintain normal nutritional status, a TPN may be prescribed to provide these intravenously (usually via a central venous catheter). Clinical situations where patients may receive TPN include malabsorption disorders, small bowel resection, sepsis or trauma, gastrointestinal obstruction, severe burns or vomiting and diarrhoea. TPN can be delivered via peripheral, central or femoral catheters depending on the content of the formula. Central administration offers advantages such as longer-term access and the ability to deliver higher concentration solutions (as the formula will have no osmolality restriction). However, central lines are generally more invasive and carry a higher infection risk.

Formulation

Each TPN order is a complex prescription that requires a pharmacist review. The aim is to provide enough fluids and calories to meet a patient's daily energy requirements based on their weight. This is determined by: (1) the degree of metabolic stress and (2) the body's ability to utilise the contents. For adults, the normal daily energy requirement is around 25-30Kcal/kg. This complex calculation is beyond the scope of this discussion, but the formulation will normally contain a bulk mixture of amino acids, lipids, dextrose and water for injection. These may be available either in a standard, commercially prepared bag (with set calories per volume of bag) or may be individualised to a patient's caloric and energy needs (in which case a pharmacist will be required to prepare aseptically). Various additives may be included under aseptic conditions, and these include:

- Electrolytes such as Na^+ , K^+ , Ca^{2+} , Mg^{2+} , PO_4^{3-} , Cl^- . Electrolytes are given to either maintain the normal requirements or replace deficits.
- Vitamins such as thiamine, vitamin K, folic acid, multivitamins and ascorbic acid. Trace elements are important for patients on long term TPN, as significant adverse effects can be associated with deficiencies. For example, selenium deficiency can result in cardiomyopathy and muscle weakness, and zinc deficiency may result in distortion of taste perception, ileus, delayed wound healing and seborrheic dermatitis.

Incompatibilities and expiration

Formulation of TPN requires consideration of potential incompatibilities such as the formation of insoluble calcium and phosphate salts. This can be prevented by ensuring the maximum quantity of ions do not exceed the recommended range within a given volume, and also through consideration of the sequence of admixture additions. Visual inspection of the final product for precipitates or particles is also very important. The admixture must remain stable during production and also during the period of infusion (usually over 24hrs). The expiration dates for a TPN in a hospital setting is 24 hours stored at fridge temperatures until required. This decreases the degradation rates of most components.

Complications

TPN is generally safe and effective with appropriate monitoring, but various complications may arise. These include catheter-related infections, and also mechanical complications such as malfunctions of tubing, administration sets or the infusion pump (these may cause serious problems such as arterial puncture, venous thrombosis or air embolism). Life threatening metabolic complications may also arise. Refeeding syndrome is a major metabolic complication of overzealous parenteral nutrition and has been implicated in deaths. This syndrome is prevented by strict daily monitoring of patients progress and electrolytes by specialist physicians.

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FOR FURTHER INFORMATION – CONTACT THE PHARMACY DEPARTMENT ON 82751763 or email: chris.alderman@rgh.sa.gov.au
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