Fourth Stage

General Surgery

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Lecture 7

Parenteral nutrition

Total parenteral nutrition (TPN) is defined as the provision of all nutritional requirements by means of the intravenous route and without the use of the gastrointestinal tract.

Parenteral nutrition is indicated when energy and protein needs cannot be met by the enteral administration of these substrates. The most frequent clinical indications relate to those patients who have undergone massive resection of the small intestine, who have intestinal fistula or who have prolonged intestinal failure for other reasons.

Routes of delivery: peripheral or central venous access In the early days of parenteral nutrition, the only energy source available was hypertonic glucose, which, being hypertonic, had to be given into a central vein to avoid thrombophlebitis. In the second half of the last century, there were a number of important developments that have influenced the administration of parenteral nutrition.

These include the identification of safe and non-toxic fat emulsions that are isotonic; pharmaceutical developments that permit carbohydrates, fats and amino acids to be mixed in single containers; and a recognition that the provision of energy during parenteral nutrition should be a mixture of glucose and fat and that energy requirements are rarely in excess of 2000 kcal/day (25–30 kcal/kg per day). These changes enabled the development of peripheral parenteral nutrition.

Peripheral feeding is appropriate for short-term feeding of up to 2 weeks. Access can be achieved either by means of a catheter inserted into a peripheral vein and maneuvered into the central venous system peripherally inserted central venous catheter (PICC) line) or by using a conventional short cannula in the wrist veins. The former method has the advantage of minimizing inconvenience to the patient and clinician. PICC lines have a mean duration of survival of 7 days. The disadvantage is that when thrombophlebitis occurs, the vein is irrevocably destroyed. In the alternative approach, intravenous nutrients are administered through a short cannula in wrist veins, infusing the patient's nutritional requirements on a cyclical basis over 12 hours. The cannula is then removed and re-sited in the contralateral arm. This tech. is not indicated in patients whom long-term feeding is anticipated.

When the central venous route is chosen, the catheter can be inserted via the subclavian or internal or external jugular vein. There is good evidence to show that the safest means of establishing central venous access is by insertion of lines under ultrasound guidance.

Most intensive care physicians and anesthetists favor cannulation of internal or external jugular veins as these vessels are easily accessible. They suffer the disadvantage that the exit site is situated inconveniently on the side of the neck, where repeated movements result in disruption of the dressing with the attendant risk of sepsis.

The infraclavicular subclavian approach is more suitable for feeding as the catheter then lies flat on the chest wall, which optimizes nursing care For longer-term parenteral nutrition, Hickman lines are preferable. These are often inserted by a radiologist with fluoroscopic guidance or ultrasound.

They incorporate a small cuff, which sits at the exit site of a subcutaneous tunnel. This is thought to minimize the possibility of line dislodgement and reduce the possibility of line sepsis.

Whatever technique is employed, a post-insertion chest x-ray is essential before feeding is commenced to confirm the absence of pneumothorax and that the catheter tip lies in the distal superior vena cava to minimize the risk of central venous or cardiac thrombosis.

Complications of parenteral nutrition:

1- Related to nutrient deficiency

- Hypoglycaemia/
- hypocalcaemia/
- hypophosphataemia/
- hypomagnesaemia (refeeding syndrome)
- Chronic deficiency syndromes (essential fatty acids, zinc, mineral and trace elements)

2- Related to overfeeding

• Excess glucose: hyperglycaemia, hyperosmolar dehydration, hepatic steatosis, hypercapnia, increased sympathetic activity, fluid retention, electrolyte abnormalities

• Excess fat: hypercholesterolaemia and formation of lipoprotein X, hypertriglyceridaemia, hypersensitivity reaction

• Excess amino acids: hyperchloraemic metabolic acidosis, hypercalcaemia, aminoacidaemia, uraemia

3- Related to sepsis

• Catheter-related sepsis

• Possible increased predisposition to systemic sepsis

4- Related to line:

• On insertion: pneumothorax, damage to adjacent artery, air embolism, thoracic duct damage, cardiac perforation or tamponade, pleural effusion, hydromediastinum

• Long-term use: occlusion, venous thrombosis.

Refeeding syndrome This syndrome is characterized by severe fluid and electrolyte shifts in malnourished patients undergoing refeeding. It can occur with either enteral or parenteral nutrition, but is more common with the latter.

It results in hypophosphatemia, hypocalcemia and hypomagnesaemia. These electrolyte disorders can result in altered myocardial function, arrhythmias, deteriorating respiratory function, liver dysfunction, seizures, confusion, coma, tetany and death.

Patients at risk include those with alcohol dependency, those suffering severe malnutrition, anorexics and those who have undergone prolonged periods of fasting.

Treatment involves matching intakes with requirements and assiduously avoiding overfeeding. Calorie delivery should be increased slowly and vitamins administered regularly. Hypophosphatasemia and hypomagnesaemia require treatment.