

INTRODUCTION

The objective of nutritional management for neonates is to provide all nutrients needed for survival and growth at all times. It provides the total nutritional needs of neonate whose lives are threatened because feeding by way of the gastrointestinal tract is impossible, inadequate, or hazardous (*Greenough et al., 2008; Hockenberry and Wong's, 2011*).

Total Parenteral nutrition is a mean of providing partially or completely the nutritional requirements for neonates incapable of tolerating enteral feeding and it can be given centrally or peripherally. However, Parenteral nutrition commonly indicated in neonates experiencing congenital malformation of the gastrointestinal tract as omphalocele, gastroschisis, tracheo-esophageal fistula malformation with valvulus, meconium and paralytic ileus, respiratory distress syndrome (RDS), extreme prematurity, sepsis and malabsorption syndrome (*Gerald and Sandra, 2006; Hockenberry and Wilson, 2010*).

Total parenteral nutrition therapy involves intravenous (IV) infusion of highly concentrated solutions of protein, glucose, and other nutrients. The solution is infused through conventional tubing with a special filters attached to remove particulate matter or microorganisms that may have contaminated the solution. The highly concentrated solutions require infusion into a vessel to allow for rapid dilution. Therefore, total parenteral nutrition is associated

with a significant numerous adverse outcomes, these outcomes are either related to the indwelling catheter, the administration set, or the infusion pump (**Turner and Gardener, 2008**)

Catheter related complications (mechanical complications) as those involving catheter placement pneumothorax, hemothorax, hydrothorax, sepsis, local skin infection, sloughs, and thromboembolism, catheter misplacement and cardiac perforation. In addition to, infectious complications and metabolic complications related to infusate which are associated with the neonate capacity for the various components of TPN solution such as hyperglycemia, azotemia, acid base disorders, anemia, bone marrow demineralization, vitamin and mineral deficiencies, hyperosmotic dehydration and fluid overload (**Mathur and Kumer, 2009; Howard and Nancy, 2011**).

Quality of care is the degree of adherent to generally recognize contemporary standards of good practice and achievement of anticipated outcomes for a particular service, procedure, diagnosis or clinical problems (**El-Sayed, 2007**). It is the degree of excellence with respect to medical and nursing services received by patients, administered in terms of technical, competence, appropriateness, acceptability, humanity and structure quality of care encompasses both the technical, scientific aspect and the art of care by which nurse's conduct in relation to their patients (**World Health Organization [WHO], 2003**).

The quality of nursing care for neonates receiving TPN requires challenging from the neonatal nurse in helping to meet the basic nutritional needs and supporting growth of high risk and preterm neonate. The neonatal nurse have a constantly role in initiating, monitoring, maintaining and hanging the TPN solution administration. Therefore, the nurse form the back bone of the neonatal care, they have a very essential role in the care of neonates receiving TPN through monitoring of anthropometry measurements, laboratory and biochemical monitoring. Consequently, the nurse must have the necessary knowledge and skills for safe and effective administration of TPN (*American Academy of Pediatrics Committee on Nutrition, 2003; Hockenberry and Wilson, 2010*).

The most important and significant factor in survival of neonates receiving TPN is the stander of nursing care provided to meet their requirements. Thus, the nurse must possess a broad knowledge of updated guidelines for care of neonates receiving TPN and practical skills in the application of nursing care directed toward solving many problems that the neonate have. Additionally, rapid observation of the neonate's general condition, continuous monitoring, accurate assessment, effective intervention and frequent evaluation, all are vital to successful nursing management of neonates' receiving TPN (*Thomas et al., 2003; Sadek, 2010*).

Significant of the study:-

Nursing management of neonates receiving total parenteral nutrition is an important challenge and vital role. The nurse must develop a plan of care based on the assessment findings to ensure consistent and comprehensive care of the neonates. However, an understanding of the basic principles of TPN administration is important for providing optimal nursing care for those neonates. The nurse should be equipped with basic knowledge and practices needed to improve the nursing care provided for neonates receiving TPN. Therefore, training program for nurses' about quality of nursing care for neonates receiving TPN is helpful in improving their knowledge and performance.

AIM OF THE STUDY

The aim of the study is to improve the nurses' knowledge and practice regarding to care of neonates receiving total parenteral nutrition through:

- A-** Assess nurses' knowledge and performance regarding care of neonates receiving TPN.
- B-** Design, implement, and evaluate the effect of the training program on improving nurses' knowledge and practice regarding to care of neonates receiving TPN.

Research hyposesis:

Nurses in neonatal intensive care units have inadequate knowledge and incompetent performance regarding care of neonates receiving total parenteral nutrition accordingly improving quality of nursing care for neonates receiving total parenteral nutrition through educational program may improve their knowledge and performance.

TOTAL PARENTERAL NUTRITION

Nutrition plays a major role in the ultimate well-being of the increasing number of high risk neonates who survive, and it is becoming clear that early nutritional intervention can have long term consequences. Because of the potential damage caused by inadequate nutrition during the early neonatal period. The dilemma of feeding the preterm infant is that of providing sufficient nutrition by enteral and parenteral routes to ensure optimal growth and development without inducing additional morbidity and mortality secondary to the feedings (**Ravindra, 2010**).

Total parenteral nutrition (TPN) is the intravenous infusion of all nutrients necessary for metabolic requirements and growth. However, it is an essential component in the management of many neonates' infants, particularly premature and low birth weight neonates infants admitted to Neonatal Intensive Care Units (NICUs). It is a hyperalimentation solution allows highly concentrated solutions of proteins, dextrose, electrolytes, vitamins, and trace elements, it must be delivered into a high flow central vein because of the solution's concentration of peripheral to avoid injury to the peripheral vasculature (**Davidson et al., 2008; Beck et al., 2010**).

The development of TPN techniques revolutionized the care of neonates unable to be fed by mouth and resulted in a considerable decrease in the morbidity and mortality formerly

associated with many disorders. Meanwhile, optimal use of routine TPN for nutritional support may influence propensity to infection, decreased growth debilities, improved neuro-development and overall morbidity in neonates. However, total parenteral nutrition (TPN) provides some of all nutrients containing fluids, energy, macro-nutrients (proteins, carbohydrate and fats) and micro-nutrients (electrolytes, major minerals, trace minerals and vitamins) for basal metabolism and growth (***Gerald and Sandra, 2006 and Marianne and Suzanne, 2010***).

Total parenteral nutrition as an adjunctive or sole therapy, it is necessary for very low birth weight premature infants, due to the immaturity of the gastrointestinal systems. Although, feeding through the gastro-intestinal tract is the preferred route for nutritional management; there are specific conditions where enteral feeding cannot be established in the first few days of life (***Carven and Constance, 2012***)

Goals of Initiating Total Parenteral Nutrition (TPN)

The goals of initiating TPN for neonates is to initially provide sufficient nutrients to prevent negative energy and nitrogen balance and essential fatty acid deficiency and support normal growth rates without increased significant morbidity. Furthermore, TPN meets current daily recommended parenteral intakes of nutrients in a safe and timely manner, in which establishment of full enteral nutrition is likely to be delayed. The provision of

balanced nutrition (carbohydrate, protein and fat) is essential for growth and prevent catabolism. Early TPN with dextrose, amino acids and lipid has been shown to reduce hypoglycemia, increase plasma amino acid level and increase albumin levels in preterm infants and to maintain tissues and promote growth in neonates unable to tolerate full enteral feeds (*Marilyn and David, 2007 and Caspi et al., 2010*).

Indications of Total Parenteral Nutrition:

Parenteral nutrition is a fundamental part of neonatal intensive care; it should be initiated immediately for medical conditions where enteral feedings are contraindicated until the medical situation allows for safe initiation of enteral feedings. The majority of neonates in the NICU requiring TPN support due to either gastrointestinal (GI) malformations or necrotizing enterocolitis (NEC). Meanwhile, gastrointestinal malformations and metabolically malformations include omphalecele, gastroschisis, intestinal atresia, volvulus, and Hirschsprung's disease (*Marilyn and David, 2007*). Other medical conditions that may indicate the use of TPN support include intractable diarrhea, tracheo-esophageal fistula malformation with valvulus, meconium and paralytic ileus, RDS, extreme prematurity, sepsis and malabsorption syndrome. In addition, neonates without likely hood of receiving effective enteral nutrition in 5-7 days and previously well –nourished are candidates for parenteral nutrition. It is recommended that TPN not be delayed to beyond 48 hours in severely malnourished

neonates who are not receiving enteral nutrition (**Hockenberry and Wilson, 2010**).

Routes of TPN administration:

Total parenteral nutrition is administered partially (PPN) or completely (TPN) to meet the nutritional requirements for neonates. It depends on energy needs, venous access, anticipated duration of support, and potential risks (**Dipak and Guha, 2006; Leifer et al., 2011**).

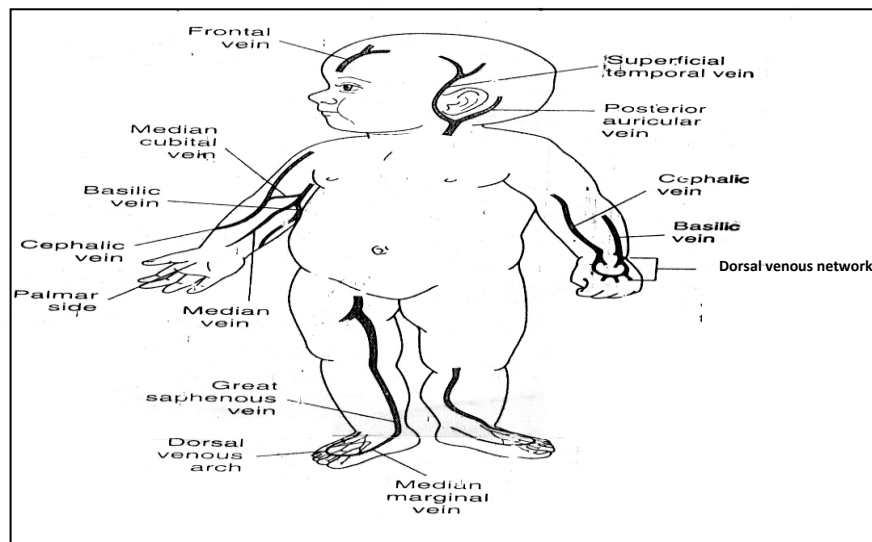
Table (1): Indications for TPN support and route of administration for newborn infants:

Route of administration	Indications for TPN
Peripheral	Temporary supply of nutrients < 2 weeks • Enteral intake • Functional gut immaturity • Temporary feeding intolerance • Medical instability
Central	Prolonged non-use of the gastrointestinal (GI) tract > 2 weeks • Short bowel syndrome • Surgical GI disorders • Necrotizing enterocolitis • Intractable diarrhea • Meconium ileus • Line access in infants extremely low in birth weight < 1.000 grams.

Ravindra K.Vegunta(2010): *Ashcraft's Pediatric Surgery, 5th ed, Elsevier Company, p.110*

The peripheral venous access is the route for TPN administrations and is a reasonable choice for a normally nourished neonate without significant fluid restrictions who is likely to tolerate an adequate enteral regimen in fewer than 2 weeks. Which maintains body stores and promotes growth in neonates with normal nutritional status. As peripheral parenteral nutrition requires a relatively large volume to allow for adequate administration of nutrients. It is recommended to limit dextrose concentration to 10% to 12.5% or a protein concentration of greater than 5%; concentrations with a final osmolality of <900 mOsm/kg to minimize risk of phlebitis and infiltration and above these amounts are delivered through central infusion. Venous access is not defined by the initial point of entry, but by the position of the catheter tip (*Howard and Nancy, 2011*).

Figure: (1): Preferred Sites for Venous Access in Infant.



Howard W., Nancy, H. (2011) Introductory Maternity Nursing, Lippincott Williams and Wilkins, London, p. 405.

Central venous access is the route for TPN administration. It can easily be obtained to promote growth and is a more reasonable choice for neonates regardless of initial nutritional status, who will be intolerant of enteral feedings for more than 2 weeks and glucose 20-25% infusion with a higher osmolality (>900 mOsm/kg) and adequate calories. Whereas, TPN administered through a central venous catheter has been complicated by mechanical catheter malfunctions and catheter-associated infections. The small-diameter silastic catheter is safe, easily inserted, and effective in the critically ill and low-birth weight neonate (*Ravindra, 2010*).

Vascular access for TPN administration:

The nutritional need is the main factor that determines vascular access route, with preference given to when use more than 2 weeks; administration of hypertonic TPN solutions (concentrations of dextrose greater than 10% and Proteins more than 5%) require central venous catheter (CVC) access with confirmed catheter tip placement (*Gerald and Sandra, 2006; James et al., 2010*).

Placement of a central catheter requires the tip either in the superior vena cava or the inferior vena cava at the junction of the right atrium. Most of the central lines are placed through a peripheral vein (basilic, femoral or saphenous) and can be maintained up to a month or more. Central lines require meticulous care to reduce the incidence of sepsis and accidental displacement. Even so, catheter related sepsis is a common problem in the NICU with peripherally

placed central catheters, broviacs, and Arrow catheters. In addition, the high risk neonates and preterm infants at risk for a patent ductus arteriosus and pulmonary edema diminishing fluid intake and improving nutritional status may be important aspects of management (*American Academy of Pediatrics [AAP], 2002; American College of Obstetrician and Gynecologists, 2012*).

Peripherally percutaneously inserted central catheters (PICCs) and non-tunneled lines are generally placed when a long-term IV access is needed, and duration may vary from several days to months. PICCs lines may be central or peripheral depending on the placement of the catheter tip. The PICCs line terminates in the systemic venous circulation (SVC), it is considered central, and termination in other vessels needs to be individually evaluated as to determine the maximum dextrose concentration that can be safely infused (*Marianne and Suzanne, 2010*).

Types of Vascular Access for TPN Administration:

I. Peripheral and midline catheters

Venous access is necessary for a determined period of time. However, a peripheral or midline catheters can be placed. The type of line used is determined by the anticipated length of time needed and the osmolarity of the substances to be infused. Peripheral intravenous catheters are indicated for short term IV access. Although, a midline catheter is threaded to the proximal portion of an extremity or neck. It can provide longer intravenous access than

a peripheral IV. However, midline catheters lower the rates of phlebitis than short peripheral catheters and with lower rates of infection and cost than central lines (*Pillitteri, 2010*).

II. Umbilical Artery catheters (UACs) and Umbilical Vein Catheters (UVCs):

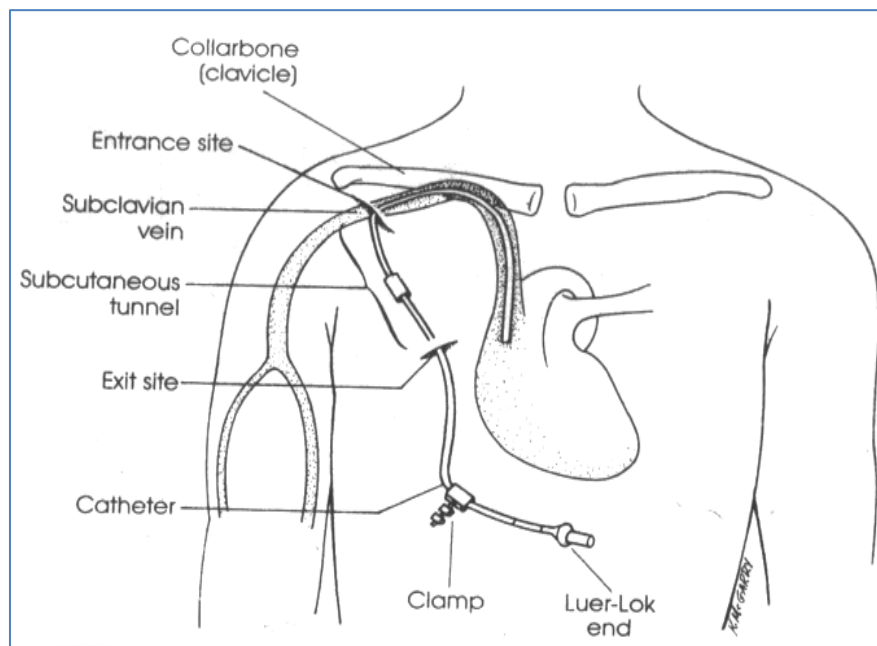
Umbilical artery catheters (UACs) and umbilical vein catheters (UVCs) are a means of vascular access for TPN, blood samplings, and blood pressure monitoring in neonates. It is appropriate route to administer TPN solutions because of the risks of thromboembolic, infection complications, fluid over load with multiple catheters and the lack of sufficient peripheral vein access. These lines generally are removed by two week of age. However, the risk of complication may increase if umbilical venous catheters are being left in place for more than 14 days (*Esther, 2007; Barbara and Lee, 2011*).

The umbilical artery catheter (UACs) for parenteral alimentation used to avoid the need for surgical placement of central venous lines and the risk of the attendant complications especially for the infusion of TPN in low birth weight infants who require arterial access for blood gas analysis. Umbilical artery catheters (UACs) and umbilical vein catheters (UVCs) each line is preserved until thrombosis or sepsis necessitates its removal or until accidental dislodgement occurs (*Shilling, 2008; Sneath, 2009*).

III. Percutaneously inserted central catheters (PICCs)

Percutaneously inserted central catheters (PICCs) are increasingly popular as an alternative for neonates need intermediate to long -term access, regardless of the site, radiographic confirmation of the intravascular placement of the catheter is mandatory before parenteral nutrition solutions are infused which advanced into the superior vena cava. Peripherally inserted central catheters (PICC's) should be used preferentially to provide central venous access in neonates receiving prolonged PN as PICC use results in improved nutrient intake and fewer insertion attempts (*Thomas et al., 2011*).

Figure (2): Percutaneously Inserted Central Catheter Placement for Total Parenteral Nutrition.



Leifer, Mc. (2011): Introduction to Maternity and Pediatric Nursing, 6th ed., W.B. Saunders; Philadelphia, p. 66

IV. Broviac catheter:

A Broviac catheter is the tunneled line typically used in neonates, it often placed when the neonate is expected to be discharged on home TPN support. However, X-ray confirmation of central line placement is essential prior to administration of a solution with a high osmolality and dextrose concentration limited to a maximum of 25 to 30 percent. Meanwhile, broviac catheter is a large bore silastic catheters are placed surgically in neonates in whom the percutaneous catheter method is not successful and long term access is anticipated (*Howard and Nancy, 2006*). Generally, the catheters are placed in the internal or external jugular veins or common facial vein by cut down and threaded to a central venous site. The distal end is tunneled subcutaneously and exited through the anterior chest wall. The catheter must be secured and dressed it under aseptic technique to prevent displacement and minimize the risk of infection (*Cooke and Mtitimila, 2010*).

Components of Total Parenteral Nutrition Solution:

Parenteral nutrition solutions supply neonates with carbohydrates, lipids, amino acids, fluids, electrolytes, and calcium, vitamins, and trace minerals. Efforts done for introduction of parenteral nutrition to produce solutions of optimal composition and tolerance (*Howard and Nancy, 2006; Hockenberry and Wilson, 2010*).