



# Should we Discontinue Parenteral Nutrition Once Babies' Enteral Intakes have Reached More than 50% of their Total Fluid Requirements or Should We Not?



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**Submission:** January 30, 2017; **Published:** March 01, 2017

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## Review

Neonatal nutrition is vital for growth, energy and multisystem maturation. Parenteral nutrition is the major resource for early positive protein balance and energy in early postnatal period. Parenteral nutrition is the term used to describe nutrition administered via the intravenous route. This may be in the form of total parenteral nutrition when intravenous route is the sole route or this could be partial parenteral nutrition where it is given in conjunction with nutrition via the enteral route. Parenteral nutrition should not be given as total parenteral nutrition as enteral nutrients are essential to the growth and function of the gut [1]. Delay in starting early enteral nutrition may be associated with poorer developmental outcome [2]. Piglet studies suggest that 40-60% of nutrition needs be delivered by enteral route for maturation of gastrointestinal tract and growth.

For the first twelve hours after birth, enteral nutrition is best avoided to allow for gut to undergo physiological adaptation. It is very important here to realize what gestation is in question as the above mentioned course of action is best reserved for extremely low birth weight babies. For VLBW and late preterm babies, enteral nutrition soon after birth carries lots of benefits. Enzyme activity of gut is minimally developed in preterm babies [3]. Minimal enteral feeding or trophic feeding should be started soon after birth [4]. This low volume feeding is used to prime the gut which is primarily helping the gut with early maturation and tolerance. This is a supplement to parenteral nutrition and cannot offer the protein to energy ratio provided by parenteral nutrition. This is reasonable as neonatal gut cannot be expected to function at same level as would be expected of a mature term baby's gut.

Energy losses [5] are thought to be less with parenteral nutrition compared to enteral nutrition because of less energy

spent on digestion and less loss of nutrients through GI tract. Postnatal growth restriction is a term used to define fall from expected intrauterine growth rate. In a study [6], it was shown that by time of discharge, 28% had weight less than 10<sup>th</sup> centile, 34% had length less than 10<sup>th</sup> centile and 16% had OFC less than 10<sup>th</sup> centile. This raises the important question as to how we can curtail the fall from expected intrauterine growth. This can be best achieved by giving optimal nutrition in form of both parenteral and enteral nutrition and alongside monitoring growth by validated measures such as anthropometry and laboratory evaluation of macro and micro nutrients.

Postnatal fluid balance has three important phases [7]. Postnatal fluid balance has three phases. Phase 1 is the transition phase which is characterised by relative oliguria followed by diuresis. Phase 2 which is the intermediate phase coincides with maturation of epidermis, fall in urine volume and low sodium excretion. Phase 3 is the phase for stable growth dominated by continuous weight gain. Enteral nutrition should be started during phase one with careful consideration of not under filling or overloading the baby with fluids. By phase three, it is ideal to have the neonate on full enteral feeding so that a period of stable growth is achieved.

There is no subjective point where it is advised to stop parenteral nutrition i.e. stopping parenteral nutrition altogether. Parenteral nutrition has its own complications i.e. catheter related complications; parenteral associated liver disease and metabolic complications. A very careful thought process is required to decide the point in time where disadvantages of parenteral nutrition outweigh its benefits and hence more aggressive approach towards stopping PN nutrition needs to be taken up.

The decision will be primarily at the helm of clinician however a multidisciplinary input involving nurses, dietician and most importantly parents is the best course of action. Concept of home parenteral nutrition is not novel and may be required for a select group but is best avoided if possible.

Until recently the major factor influencing starting and advancing enteral nutrition has been necrotising enterocolitis. Feeding strategies revolve around this issue and are designed on presumed evidence of tolerance versus intolerance using symptoms such as abdominal distension, pre-feeding residual volume, bile stained aspirate and so forth [8]. As a common practise, after more than 50-75% of caloric needs are tolerated enterally, babies are gradually weaned to half of their total parenteral needs. As a further strategy, parenteral feeds are weaned while enteral feeds are advanced in a proportionate manner to avoid overloading with fluids [8]. Parenteral feeds should be eventually discontinued once 75 percent of caloric needs are met enterally. Initial aim of parenteral nutrition is to provide amino acid and energy to promote positive protein and energy balance. Subsequent aim is to provide optimal growth and weigh gain until enteral feeds are established.

Absolute indications of parenteral nutrition are gastrointestinal disorders requiring surgery, meconium ileums, short bowel syndrome, intractable diarrhea, necrotising enterocolitis and extreme prematurity i.e. infants who are less than 1000 grams or less than 28 weeks of gestation. For infants between 1000-1500 grams or gestation between 28-32 weeks, use of parenteral nutrition is debatable. Most recent data Ehrenkranz et al. [9], Embleton et al. [10] has shown benefit in this population but there is no international consensus. Common practice is to make gradual increase in parenteral nutrition to improve tolerance. In the study [11] full early nutritional requirements within one hour of birth by parenteral route was tolerated well. Early enteral nutrition should be started at the same time. Morgan et al. [12] in recent systemic review suggested that delay in introduction of progressive enteral feeds significantly increases time taken to establish full enteral feeds. This increases need for parenteral nutrition and its associated morbidities.

One of the striking issues which is vital is the actual intake by the neonate. Fluids may be prescribed at total volume of 150ml/kg/day but with inconsistent fluid restriction and additional drug infusions, the actual intake is much reduced. This can cause serious compromise in growth. In situations where fluid restriction is necessary, calorie-dense formulas are often needed to meet nutritional requirements. Regular review of actual intake of parenteral and enteral nutrition is needed to ensure that desired protein, energy and micronutrient requirements are met. If there are deviations from desired intakes, this should be rectified by increasing enteral feeds up to desired volume as long as there are no indicators of intolerance. Enteral feeds should be advanced as per local unit guidelines. Leaf et al. [13] showed from ADEPT trial that early introduction of feeds led to early establishment of

full enteral feeds with no apparent increase in NEC. The rapid the advancement of enteral feeds is, the easier it becomes to wean down parenteral feeds.

There are complications associated with enteral feeds as well. Most common ones are gastrointestinal and they tend to occur in first week as the gut adapts to formula in case of formula feeds. This is not so much of a case with breast feeding. Mechanical complications associated with mode of feeding include obstruction, dislodgement or displacement of tubes. Metabolic complications similar to parenteral nutrition can occur as well. These are mostly reversible.

Children can develop oral aversion because of negative oral stimuli i.e. frequent vomiting, intubation, suctioning or delayed start to enteral feeds. This can be reduced by early non nutritive sucking by putting colostrum into the mouth [14]. This involves placing small amounts of the colostrum directly onto the oral mucosa with the expectation that the colostrum or selected components are absorbed by the mucous membranes. Milk produced by mothers of least immature infants contains the highest concentrations of protective factors in colostrum.

In summary, parenteral nutrition should not be discontinued once 50 percent of total fluid requirement is met by enteral feeds however it should be weaned with an aggressive approach. The endpoint of stopping parenteral nutrition will be decided by multiple factors including growth, tolerance versus intolerance, any enteral feeding complications or any parenteral feeding complications. The input from parents and nursing staff accounts for a lot in decision making as well.

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DOI: [10.19080/AJPN.2017.03.555616](https://doi.org/10.19080/AJPN.2017.03.555616)

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