

## EVALUATION OF THE PARENTERAL NUTRITION SERVICES IN HOSPITAL PULAU PINANG

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*Parenteral nutrition (PN) has been practiced in Hospital Pulau Pinang, Malaysia since 1986. However, there is no published data on the cost, complications and outcome of patients receiving PN in this hospital. A retrospective study was carried out to evaluate the cost, complications and outcome of PN. Data were obtained from patient medical records and analysed using SPSS version 11. From 2003 to 2005, 429 PN cases were evaluated. Of the PN cases, 65% were neonates, 28.2% adults and 6.8% paediatric, where 60.8% of patients were male and 38.5% were female. Malay patients constituted 57.3%, Chinese 30.8% and Indian 11.9%. The reasons for PN were feeding intolerance (86.7%), oral intake restrictions (9.3%), poor oral intake (1.4%) and others (2.6%). The average cost for PN in a neonate was found to be RM185 ± 69, RM 233 ± 126 for a paediatric patient and RM 235 ± 107 for an adult. PN-associated complications were bacterial sepsis (30.4%), metabolic acidosis (13.0%), catheter dislodgment (8.7%), long line swelling (8.7%), hepatic complication (21.8%), long line blockage (4.4%) and catheter-related infection (13.0%). A total of 82.7% of cases tolerated oral nutrition after PN, 7.4% expired, 5.3% developed PN complications and others were discharged, transferred to other ward, transferred to another hospital, or discharged at own risk (0.3%). The study showed a significant difference in the cost of PN in each group of patients ( $p = 0.002$ ). We concluded that PN services in Hospital Pulau Pinang were associated with low PN-related complications and good outcomes.*

**Keywords:** Parenteral Nutrition, Cost, Outcome, Complication, Malaysia

### INTRODUCTION

Modern clinical nutrition was introduced around 35 years ago by Dudrick and Rhoads (1971). Parenteral nutrition (PN) provides life-sustaining therapy for patients who are unable to consume conventional dietary therapy either orally or enterally. It is a relatively new therapeutic tool used in the clinical management of patients. It is also known as hyperalimentation or intravenous nutrition. Hyperalimentation, which is the provision of nutrients at high concentration intravenously, was used during the early days of PN. It was associated with most of the adverse effects of PN therapy. Nowadays, the term PN is widely used in the

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literature to denote the administration of nutrients intravenously (Shamsuddin 2003).

Basically, there are two types of parenteral nutrition, namely total parenteral nutrition (TPN) and partial parenteral nutrition (PPN). TPN is used when the whole of nutritional requirements is administered parenterally. PPN on the other hand, is the concurrent intravenous administration of nutrients together with oral or enteral nutrition for the same therapeutic objective. The nutritional components of a standard PN regimen include the macronutrients (amino acids, carbohydrate and fats), electrolytes, micronutrients (trace elements and vitamins) and water. Carbohydrate (in the form of glucose or dextrose) and lipids are the major sources of energy (Shamsuddin 2003).

In Malaysia, PN service was introduced in 1986 at two general hospitals; Hospital Kuantan and Hospital Pulau Pinang (Bahari 1990). Since then, many studies on the PN practice in Malaysian hospitals have been reported (Bahari 1990; Shamsuddin and Bahari 1994; Bahari 1999; Yusuf and Bahari 1999). However, studies reporting complications and costs of PN in Malaysian hospitals are lacking. Therefore, this study was carried out to determine the current PN practice in Hospital Pulau Pinang and to evaluate the outcomes and costs associated with it.

## METHODS

This retrospective study was carried out at Hospital Pulau Pinang, Malaysia using data from all PN cases from 2003 to 2005. A specially-designed data collection form was used to collect data on the demographic of PN patients, diagnosis, complications, outcomes and the costs of PN. The cost of personnel and other indirect costs were not included because there were no data available for the PN preparation time. All data was analysed using SPSS version 11 and descriptive statistic was used as appropriate. Analysis of variance was used to test the difference in cost of PN between groups. A p value of < 0.05 was considered significant.

The cost of PN solution was calculated from the cost of each individual nutrient added into the PN bag. They were Vaminolact®, Vamin G®, Aminoplasma® 10%, Aminoplasma® 12.5%, dextrose, calcium gluconate, magnesium sulphate, potassium chloride, sodium chloride 0.9%, sodium chloride 0.3%, potassium hydrogen phosphate, Addamel®,

Peditrace®, Soluvit-N®, Lipofundin® 20%, Intralipid® 20% and water for injection. The total cost was calculated by multiplying the daily cost with the number of PN days.

## RESULTS AND DISCUSSION

There were 429 PN cases between 2003 to 2005. The majority of these cases were premature neonates 279 (65%) followed by adults 121 (28.2%) and paediatrics 29 (6.8%). There were 261 (60.8%) male, 165 (38.5%) female, one (0.2%) anomalous genitalia and two (0.5%) were not recorded. There were 246 Malay patients (57.3%), 132 Chinese (30.8%) and 51 Indian (11.9%). Table 1 gives the details of patient demography.

The findings of this study corresponded to the study by Bahari and Razak (1996) that found adult patients receiving PN to be less than paediatric patients. In their study, they found that PN cases were 67.1% in paediatrics and 32.9% in adults. Both studies have shown that paediatrics were the main group receiving PN. In this study, the majority of our subjects were premature (65%) and usually premature cases have some degree of gastrointestinal tract (GIT) malfunction that require GIT rest. This could be due to the immaturity of their digestive systems and inability to absorb adequate calories to meet their high calorific requirements.

**Table 1:** Demographic data of patients receiving parenteral nutrition

		Number	Percentage
<b>Age group</b>	Premature	279	65.0
	Paediatric	29	6.8
	Adult	121	28.2
<b>Race</b>	Malay	246	57.3
	Chinese	132	30.8
	Indian	51	11.9
<b>Sex</b>	Male	261	60.8
	Female	165	38.5
	Anomalous genitalia	1	0.2
	Not mentioned	2	0.5

**Table 2:** Diagnosis and reasons of parenteral nutrition

		Frequency	Percent %
<b>Diagnosis</b>	Prematurity	227	52.9
	Post operation	43	10.0
	Perforation of GIT	14	3.3
	Sepsis+shock	8	1.9
	Cancer of the stomach	8	1.9
	End stage renal failure on dialysis	7	1.6
	Necrotizing enterocolitis	7	1.6
	Peritonitis	7	1.6
	Cancer of the rectum	5	1.2
	Upper GIT bleeding	5	1.2
	Diaphragmatic hernia	5	1.2
	Others	93	21.6
	<b>Reason for PN</b>	Feeding intolerance	372
Oral intake restrictions (NBM)		40	9.3
Poor oral intake		6	1.4
Others		11	2.6

Table 2 shows the diagnosis and the reasons for the PN. 86.7% of all cases were due to feeding intolerance. This could be due to prematurity (52.9%), post-surgery (10%), perforated GIT (3.3%) and other conditions requiring GIT rest. This is also in accordance to the indications of PN and the hospital PN policy (Bahari 1996).

Table 3 shows the outcome of PN in our patients. A total of 82.7% of patients tolerated oral feeding, while death occurred in 7.4%. This finding is better than the finding of previous study (Bahari and Razak 1996), which found only 45% to 50% of patients, tolerated feeding and 11% to 45% died. The differences in the outcomes could be due to the general improvement of the PN services over the years.

Table 4 shows the complications of PN in our patients. Majority of patients did not experience any PN complications (82.7%). The study found that of those who developed complications, almost one third were due to sepsis or 1.6% of the total number of PN cases. Our results showed a lower rate of complications compared to a previous study by Bahari (1990). Bahari (1990) showed that the PN-related sepsis occurred in 50% of adult and 41% of paediatric patients. The author also reported a higher frequency of metabolic complications in their patients (28% to 45%).

**Table 3:** Outcomes of parenteral nutrition

Outcome	Frequency	Percent %
Tolerating feeding	355	82.7
Death	32	7.4
PN complications	23	5.3
Patient very ill	9	2.1
Discharged home	3	0.7
Transferred to other ward	2	0.5
Transferred to another hospital	3	0.7
Went for surgery	1	0.3
Discharged home at own risk	1	0.3

Knafelz *et al.* (2003) found that mechanical complications and infections occurred in 52% and 26% of their patients, respectively. Other PN-related complications reported were, metabolic acidosis (3%) and hepatic complications (19%). The difference in complications could be due to the improvement in facilities and techniques with time. These could also indicate the improvement in the patient selection and patient monitoring by the health care providers in Hospital Pulau Pinang.

Some patients were already having sepsis prior to PN. This has made it difficult to differentiate whether the sepsis was related to PN or not related to PN. However, in practice the PN will be discontinued whenever the patient develops fever regardless of the source of infection. It will then be resumed once the fever resolved.

Melville *et al.* (1997) explained the reasons for the possible cause of sepsis in PN patients. These include malnutrition, structural intestinal defects, alteration in the immune system such as in congenital defects, the use of immunosuppressive drugs, viruses' infections such as the immunodeficiency virus and extreme age. Sepsis may also occur due to the mishandling of catheter and its site of insertion such as improper dressing and the use of PN line for the administration of drugs and blood products.

The percentage of death in our patients is high (7.4%), with the majority of them occurred among premature and very low birth weight neonates. Out of those who died, only two were sepsis-related. Majority of the subjects were able to tolerate feeding (82.7%). Previous study by Festen *et al.* (2002) on the outcome of PN in apple peel atresia (intestinal atresia) patients showed a declining in the number of death from 70% to 26% and 14% in 1960's, 1970's and 1990's, respectively. Most frequent causes of death were sepsis (22%) and anastomotic dysfunction (20%),

followed by intestinal gangrene (12%). The differences in the death rate could be due to the difference in the population of the subjects between both studies.

The average daily cost of adult patients receiving TPN was found to be RM 235 ± 107, as compared to paediatric patients RM 233 ± 126 and premature RM 185 ± 69. In addition, the cost of PN per day was increasing with different age group (ANOVA,  $p = 0.002$ ). This difference could be due to the high nutritional requirement of adult. The cost estimation in this study is only for the PN solutions, bag and devices for the preparation of PN. However the average cost is higher than previously reported by Bahari (1996). The author reported that the cost for paediatric PN ranged from RM 60 to RM 100 daily and for adult TPN ranged from RM 105 to RM 140 daily. The increase in cost could be due to the escalating cost of raw materials such as TPN bags, solutions and devices. The finding of the study is similar to the study done by Zaleski *et al.* (1997) that showed the daily cost of TPN was (US\$57) which include the cost of nutrients (US\$50), supplies such as gloves, mask and syringes (US\$2), and cost of labor (US\$5). The indirect costs were not included in the study because the data on the preparation time was not recorded in the PN record.

**Table 4:** Complications of parenteral nutrition

		Frequency	Percent %
<b>Complications due to TPN</b>	Complication	23	5.4
	Tolerating feeding	355	82.7
	Record not available	51	11.9
<b>Type of complications</b>			
Metabolic Complication	Acidosis	3	13.0
Mechanical complications	Catheter dislodgment	2	8.7
	Long line swelling	2	8.7
	Long line blockage	1	4.4
Infections	Bacterial sepsis	7	30.4
	Catheter-related infections	3	13.0
Hepatic complications	Hepatic complication	5	21.8

## CONCLUSION

As PN services in Malaysia is still new, the evaluation of its impact, outcome and cost is very important. The finding of this study shows that PN service is not associated with high rate of complications as expected and has favourable outcomes.

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