

Pediatrics' Total Parenteral Nutrition: Initiative and implementation of standardized formulation in Saudi Arabia

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Abstract

The national total parental nutrition program with an emphasis on pediatrics started before several ago at Ministry of health hospitals In Kingdom of Saudi Arabia. The program covered several regions and consisted from the foundation of Intravenous Admixture and preparation of pediatric parenteral nutrition to administration and follow up of patients outcomes. In addition to the prior system, the new initiative project with the standardized formulation of pediatric's parenteral nutrition is the complementary project of the parental nutrition for pediatrics. The project initiated to prevent drug-related problems of parental nutrition, improve patient clinical outcome and reduce the unnecessary economic burden on the healthcare system. It is the new system in the Middle East and Gulf counties in additional to Saudi Arabia. The initiatives are the systemic implementation of standardized pediatrics formulation using management project tools of starting new idea until finding in the ground.

Keywords: Adult total parenteral nutrition, formulation, Pharmacy, Ministry of Health, Saudi Arabia.

INTRODUCTION

The general administration of pharmaceutical care established several pharmacy practice program for pediatrics for high alert medications [1]. It included national total parental nutrition and Intravenous national therapy [2-3]. The administration established a strategic plan for the national Total parental nutrition (TPN) program included the standardized concentration of TPN. Three hospitals in Riyadh city started to formulate specific physician order form as first initiatives program in the Kingdom of Saudi Arabia. Several publications showed the application of the standardized concentration of TPN around the world to improve outcome and reduce the cost related issues [4-7]. Half of the hospital only had standardized concentration formulation in the TPN for pediatrics in Saudi Arabia [8]. Also, the formulation will prevent dosing errors, and any drug therapy omission prevents by the pharmacist. The formulation of standardized concentration prevented nutrition-related problems in

pediatrics and reduced the cost related to nutrition in the Kingdom of Saudi Arabia. The author is not familiar with any investigations published in Saudi Arabia, and Gulf countries or the Middle East described the standardized formulation of Pediatrics' Total Parenteral nutrition.

PEDIATRICS TOTAL PARENTERAL NUTRITION STANDARDIZED FORMULATION IN SAUDI ARABIA

It is the standardized formulation of total parental nutrition for pediatrics. The formulation drove from current literature and American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines for pediatrics' population with an average of fifteen-kilogram body weight [9]. The formulation consisted of several parts demographic data of the patients, total macronutrients, total micronutrients, the calculated total calories and non-protein calories over nitrogen ratio, and pharmacy preparation part. The formulation consisted of first three consequence days of starting

TPN through central line administration. Each day contained one-third of the quantities of the total fluid requirements, total calories, carbohydrates, protein, electrolyte, trace elements and multivitamins as explored in appendix 1, 2 and 3.

SWOT ANALYSIS

The analysis of benefits and risk done by SWOT (Strength, Weakness, Opportunities, and Threats) analysis method. The strength of the pediatrics formulations including all information of starting total parental nutrition is available, dosing of TPN component is available, prevent mistakes in writing TPN pediatrics orders are available. The weak points are including the formulation is not individualized for all patients, It is not contained the TPN administration instruction. Also, it cannot apply to several disease renal or hepatic failure. The opportunity that is including it is straightforward to form to convert them into computerized, and physician order entry; it can calculate all TPN statistical information. The threat point is including the physician or pharmacist not used the formulation.

Implementations Steps of Pediatrics' Total Parenteral Nutrition Standardized Formulation

The pharmacy department Organize Consultation Committee from expert pharmacist especially from Intravenous admixture and total parental nutrition services and clinical pharmacists inside the pharmacy department. The committee should extensively review then approve the standardized formulation of pediatrics total parenteral nutrition. The head of the committee will contact the surgical and medical department for final revisions of the drafting and approval. The head of pharmacy services will submit the final draft of the formulation to the Pharmacy and Therapeutic committee for review and approval. The head of the committee will arrange with Computer department to make an electronic order form. The pharmacy education coordinator arranges with all department including nursing, surgical and medical department to Educate and train the medical staff of using the formulation with additional to pharmacy staff. The pharmacy quality management will set up the key performance indicators (KPI) to measure the impact of the project. All pharmacy concern team including TPN Preparation, clinical pharmacist will Collect the KPI of the project retrospectively in the past three to six months, then collect the data prospectively in the coming months. The head of the committee will contact nursing, and surgical departments started with one surgical department as the pilot trial. The pharmacist will Review the pilot trial and correct the form according to the pharmacy consultation committee. The team will expand to all surgical department and medical department. Review and alter the shape accordingly through the committee. The head of the committee will

expand to all hospital departments including pediatrics' critical care, Review and adjust the formulation accordingly. The pharmacy quality management coordinator will measure the impact of the project by comparing the KPI before and after starting the project. The head of the committee will analyze the results and review by the consultation committee. The head of the pharmacy will submit the final report to the Pharmacy and the therapeutic committee for final touch and comments. The consultation team will Review the last comments on the project, update it accordingly, and continue the project for the next year.

CONCLUSION

The pediatrics' standardized formulation of the total parental nutrition is new initiative of pharmacy quality and medications safety project. It assists for the high alert product in preventing medical errors and related issues at Hospitals in Kingdom of Saudi Arabia.

Acknowledgment: None

Conflict of Interest: None

Abbreviation Used: TPN: Total parental nutrition, ASPEN: American Society for Parenteral and Enteral Nutrition, SWOT: Strength, Weakness, Opportunities, and Threats. KPI: Key Performance Indicators

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KINGDOM OF SAUDI ARABIA MINISTRY OF HEALTH PHARMACEUTICAL SERVICES IV ADMIXTURE AND TPN DEPARTMENT									
TOTAL PARENTERAL NUTRITION PEDIATRICS FORM		Name: _____ P1							
PRESCRIBER TO COMPLETE NOS. 1 UP TO 8		Hospital No: _____							
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">NO. 1</td> <td>Date: / / 200...</td> </tr> <tr> <td></td> <td>Day(s) of TPN: 1st Day..... (Begin with 1)</td> </tr> <tr> <td></td> <td><input type="checkbox"/> Central <input type="checkbox"/> Peripheral</td> </tr> </table>		NO. 1	Date: / / 200...		Day(s) of TPN: 1st Day (Begin with 1)		<input type="checkbox"/> Central <input type="checkbox"/> Peripheral	Nationality: _____	
NO. 1	Date: / / 200...								
	Day(s) of TPN: 1st Day (Begin with 1)								
	<input type="checkbox"/> Central <input type="checkbox"/> Peripheral								
		Treating physician: _____							
		(TPN Formula for Pediatrics 15 kg Non-diabetic normal kidney & liver function)							
NO.2	Dextrose: 150 gm/day (6-16mg/kg/min=8.64-23 gm/kg/day)	Ward	Age						
NO.3	Amino Acids: 10 gm/day (start with 0.5gm/kg/day, increment by 0.5gm/kg/day, up to 3 gm/kg/day)-monitor BUN	Wt.	15 kg Height cm						
NO.4	Fat 20% : 10 gm/day (start with 0.5 gm/kg/day, increment by 0.5gm/kg/day, up to 2.5-3gm/kg/day)-monitor TGs	Diagnosis							
NO.5	Total volume of TPN: 500 mL/day Total volume of FAT: 50 mL/day Total volume of IVF: _____ mL/day (Type of IVF:) Total volume of PO: _____ mL/day Total fluid intake: _____ mL/day	TPN indication(s)							
NO.6	TPN rate: _____ mL/hr FAT rate: _____ mL/hr over _____ hrs (max. rate: 0.11 gm/kg/hr)	NO. 8	Daily Calories intake						
		Dextrose (gm/day) × 3.4 = (150) × 3.4 = 510 Kcal/day							
		Fat (gm/day) × 10 = (10) × 10 = 100 Kcal/day							
		Total = 610 Kcal /day							
		Total/Wt = 40.6 Kcal /kg/day							
		Non Protein Calories/ Nitrogen : 381.25 / 1 (Recommended ratio = 150 / 1)							
	NO. 7								
Additives	Prescribed amt/day	Maintenance Range	Notes						
Sodium	30	2-4 Mmol/kg/day							
Potassium	10	2-4 Mmol/kg/day							
Calcium	2.3	0.25-0.5 Mmol/kg/day	Give as Calcium Gluconate PHARMACY: check Ca/PO4 compatibility						
Magnesium	3	0.25-0.5 Mmol/kg/day							
Phosphate	3	0.5-1.5 Mmol/kg/day	Na PO4(1mL= 3 Mmol PO4 & 4 Mmol Na) KPO4(1mL= 3 Mmol PO4 & 4.4 Mmol Na)						
Chloride	30	2-4 Mmol/kg/day							
Acetate		As needed	Acetate and Cl should be in 1:1, unless it is indicated						
Fat soluble vit.	2.5	Neonates, <2.5kg: 4 mL/kg Children, >2.5kg: 10 mL/day (Vitalipid N Infant*)	-Max dose=10 mL/day (1mL contains 20 mcg Vit K1) -Use this brand for age of ≤ 11 years						
Water soluble vit.	0.5	>10kg: 10 mL/day <10kg: 1mL/kg (Soluivit™N)*	Contains: Vit. B1, B2, nicotinamide, B6, pantothenic acid, C, biotin, folic acid & B12						
Trace Elements	0.5	0.1 mL/kg of Multitrace™. 4 Pediatric*	-Contains: zinc, copper, manganese & chromium -Caution: in renal dysf., biliary tract obstruction -Use this brand for pts ≤ 15 kg, for >15kg give adult form						
Insulin, regular		As needed							
Heparin		0.5-1 unit/ each mL of TPN	USED FOR PERIPHERAL TPN, Check PT/PTT, avoid in case of HIT or thrombocytopenia						
Hydrocortisone			USED FOR PERIPHERAL TPN and to prevent thrombophlebitis						
			<ul style="list-style-type: none"> Base Solution: _____mL Dextrose _____% _____mL Amino A _____% _____mL Sterile Water Additives: _____mL Sodium _____ _____mL Potassium _____ _____mL Calcium _____ _____mL Magnesium So4 _____ _____mL Potassium _____ _____mL _____ Fat: Fat _____% Volume _____ mL 						
* Check with IV Room for brand changing									
Prescriber name & sign.		Bleep of prescriber	RPh name						
Prescriber ID		Nurse name	Technician						

**TOTAL PARENTERAL NUTRITION
PEDIATRICS FORM**

PRESCRIBER TO COMPLETE NOS. 1 UP TO 8

NO. 1	Date: / / 200... Day(s) of TPN: 2nd Day (Begin with 1) <input type="checkbox"/> Central <input type="checkbox"/> Peripheral
NO.2	Dextrose: 200 gm/day (6-16mg/kg/min=8.64-23 gm/kg/day)
NO.3	Amino Acids: 20 gm/day (start with 0.5gm/kg/day, increment by 0.5gm/kg/day, up to 3 gm/kg/day)-monitor BUN
NO.4	Fat 20% : 20 gm/day (start with 0.5 gm/kg/day, increment by 0.5gm/kg/day, up to 2.5-3gm/kg/day)-monitor TGs
NO.5	Total volume of TPN: 750 mL/day Total volume of FAT: 100 mL/day Total volume of IVF: mL/day (Type of IVF:) Total volume of PO: mL/day Total fluid intake: mL/day
NO.6	TPN rate: mL/hr FAT rate: mL/hr over hrs (max. rate: 0.11 gm/kg/hr)

Name: _____ **P2**
Hospital No: _____
Nationality: _____
Treating physician: _____
(TPN Formula for Pediatrics 15 kg Non-diabetic normal kidney & liver function)

Ward		Age	
Wt.	kg	Height	cm
Diagnosis			
TPN indication(s)			
NO. 8	Daily Calories intake		
Dextrose (gm/day) × 3.4 = (200) × 3.4 = 680 Kcal/day			
Fat (gm/day) × 10 = (20) × 10 = 200 Kcal/day			
Total = 880 Kcal /day			
Total/Wt = 58.6 Kcal /kg/day			
Non Protein Calories/ Nitrogen : 275 / 1 (Recommended ratio = 150 / 1)			

Additives	Prescribed amt/day	Maintenance Range	Notes	FOR PHARMACY ONLY
Sodium	60	2-4 Mmol/kg/day		<ul style="list-style-type: none"> Base Solution: _____ml Dextrose 50% % _____ml Amino A 10 % _____ml Sterile Water
Potassium	20	2-4 Mmol/kg/day		
Calcium	4.6	0.25-0.5 Mmol/kg/day	Give as Calcium Gluconate PHARMACY: check Ca/PO4 compatibility	
Magnesium	8	0.25-0.5 Mmol/kg/day		<ul style="list-style-type: none"> Additives: _____mL Sodium _____ _____mL Potassium _____ _____mL Calcium _____ _____mL Magnesium So4 _____ _____mL Potassium _____ _____mL _____
Phosphate	6	0.5-1.5 Mmol/kg/day	Na PO4(1mL= 3 Mmol PO4 & 4 Mmol Na) KPO4(1mL= 3 Mmol PO4 & 4.4 Mmol Na)	
Chloride	60	2-4 Mmol/kg/day		<ul style="list-style-type: none"> Fat: Fat _____% Volume _____ mL
Acetate		As needed	Acetate and Cl should be in 1:1, unless it is indicated	
Fat soluble vit.	5	Neonates, <2.5kg: 4 mL/kg Children, >2.5kg:10 mL/day (Vitalipid N Infant*)*	-Max dose=10 mL/day (1mL contains 20 mcg Vit K1) - Use this brand for age of ≤ 11 years	
Water soluble vit.	0.75	>10kg: 10 mL/day <10kg:1mL/kg (Solvit™N)*	Contains: Vit. B1, B2, nicotinamide, B6, pantothenic acid, C, biotin, folic acid & B12	
Trace Elements	1	0.1 mL/kg of Multitrace™, 4 Pediatric*	-Contains: zinc, cooper, manganese & chromium -Caution: in renal dysf., biliary tract obstruction -Use this brand for pts ≤ 15 kg, for >15kg give adult form	
Insulin, regular		As needed		
Heparin		0.5-1 unit/ each mL of TPN	USED FOR PERIPHERAL TPN, Check PT/PTT, avoid in case of HIT or thrombocytopenia	
Hydrocortisone			USED FOR PERIPHERAL TPN and to prevent thrombophlebitis	

* Check with IV Room for brand changing

Prescriber name & sign.		Bleep of prescriber		RPh name	
Prescriber ID		Nurse name		Technician	

**TOTAL PARENTERAL NUTRITION
PEDIATRICS FORM**

PRESCRIBER TO COMPLETE NOS. 1 UP TO 8

NO. 1	Date: / / 200...
	Day(s) of TPN: 3rd Day (Begin with 1)
	<input type="checkbox"/> Central <input type="checkbox"/> Peripheral
NO.2	Dextrose: 450 gm/day (6-16mg/kg/min=8.64-23 gm/kg/day)
NO.3	Amino Acids: 30 gm/day (start with 0.5gm/kg/day, increment by 0.5gm/kg/day, up to 3 gm/kg/day)-monitor BUN
NO.4	Fat 20% : 30 gm /day (start with 0.5 gm/kg/day, increment by 0.5gm/kg/day, up to 2.5-3gm/kg/day)-monitor TGs
NO.5	Total volume of TPN: mL/day Total volume of FAT: mL/day Total volume of IVF: mL/day (Type of IVF:) Total volume of PO: mL/day Total fluid intake: mL/day
NO.6	TPN rate: mL/hr FAT rate: mL/hr over hrs (max. rate: 0.11 gm/kg/hr)

NO. 7

Additives	Prescribed amt/day	Maintenance Range	Notes	FOR PHARMACY ONLY
Sodium	45	2-4 Mmol/kg/day		<ul style="list-style-type: none"> • Base Solution: _____ ml Dextrose _____ % _____ ml Amino A _____ % _____ ml Sterile Water • Additives: _____ mL Sodium _____ _____ mL Potassium _____ _____ mL Calcium _____ _____ mL Magnesium So4 _____ _____ mL Potassium _____ _____ mL _____ • Fat: Fat _____ % Volume _____ mL
Potassium	30	2-4 Mmol/kg/day		
Calcium	6.9	0.25-0.5 Mmol/kg/day	Give as Calcium Gluconate PHARMACY: check Ca/PO4 compatibility	
Magnesium	12	0.25-0.5 Mmol/kg/day		
Phosphate	9	0.5-1.5 Mmol/kg/day	Na PO4(1mL= 3 Mmol PO4 & 4 Mmol Na) KPO4(1mL= 3 Mmol PO4 & 4.4 Mmol Na)	
Chloride	45	2-4 Mmol/kg/day		
Acetate		As needed	Acetate and Cl should be in 1:1, unless it is indicated	
Fat soluble vit.	10	Neonates, <2.5kg: 4 mL/kg Children, >2.5kg: 10 mL/day (Vitalipid N Infant®)*	-Max dose=10 mL/day (1mL contains 20 mcg Vit K1) - Use this brand for age of ≤ 11 years.	
Water soluble vit.	10	>10kg: 10 mL/day <10kg: 1 mL/kg (Solvit™ N)*	Contains: Vit. B1, B2, nicotinamide, B6, pantothenic acid, C, biotin, folic acid & B12	
Trace Elements	1	0.1 mL/kg of Multitrace™. 4 Pediatric*	-Contains: zinc, cooper, manganese & chromium -Caution: in renal dysf., biliary tract obstruction -Use this brand for pts ≤ 15 kg, for >15kg give adult form	
Insulin, regular		As needed		
Heparin		0.5-1 unit/ each mL of TPN	USED FOR PERIPHERAL TPN, Check PT/PTT, avoid in case of HIT or thrombocytopenia	
Hydrocortisone			USED FOR PERIPHERAL TPN and to prevent thrombophlebitis	

* Check with IV Room for brand changing

Prescriber name & sign.		Bleep of prescriber		RPh name	
Prescriber ID		Nurse name		Technician	

Name: _____ **P3**
Hospital No: _____
Nationality: _____
Treating physician: _____
(TPN Formula for Pediatrics 15 kg Non-diabetic normal kidney & liver function)

Ward		Age	
Wt.	15 kg	Height	cm
Diagnosis			
TPN indication(s)			
NO. 8	Daily Calories intake		
Dextrose (gm/day) × 3.4 = () × 3.4 = Kcal/day			
Fat (gm/day) × 10 = () × 10 = Kcal/day			
Total = Kcal /day			
Total/Wt = Kcal /kg/day			
Non Protein Calories/ Nitrogen : / (Recommended ratio = 150 / 1)			