1. INTRODUCTION

Parenteral Nutrition (PN) refers to the provision of nutrition via a central or peripheral vein and is required when oral and enteral nutrition are insufficient or unsafe. The formula may include carbohydrates, amino acids, lipids, electrolytes, and/or micronutrients, either in a 2-in-1 or multi-chamber bag (ready-made) formula. PN is continuously infused over 24 hours; some patients receive cyclic PN according to patient status. Appropriate use of this complex therapy maximizes clinical benefit while minimizing the potential risk of adverse events.

2. PURPOSE

2.1. To provide high-standard, effective PN services to adult patients to meet their nutritional requirements when oral and enteral feeding cannot be tolerated.

- 2.1.1. Patients with gastrointestinal tract malfunction or when it cannot be accessed.
- 2.1.2. Patients who cannot be adequately nourished by enteral feeding for 5-7 days or more.
- 2.1.3. Patients with short bowel syndrome, fistulas, and other indications.
- 2.1.4. A patient who needs prolonged bowel rest for any reason.

3. DEFINITION

Parenteral Nutrition (PN): an intravenous solution containing nutritional elements necessary for growth, healing, and providing the body with the required calories. Mixing PN components requires professional and technical expertise to assure compatibility, stability, sterility, and the absence of any other type of contamination, such as particulate contamination.

Abacus®	The software that is being used for PN order entry.
CVC	Central Venous Catheter.
PIVC	Peripheral intravenous catheter.
IVFE	Intravenous Fat Emulsion.

PN	Parenteral Nutrition.
2 in 1 PN	Admixture that contains amino acids, carbohydrates, electrolytes, vitamins, and trace elements in a single IV bag while IVFE is kept separately.
VAD	Venous access device.
C/S	Culture and sensitivity.
MCB	Multi-Chamber Bag (Ready-made) Standardized, commercially available PN products are formulations available from a manufacturer and requiring fewer compounding steps before administration.

4. APPLICABILITY

For all indicated adult patient in PSMMC.

5. RESPONSIBILITIES

5.1. **PN team members, including an** intensive care physician, PN clinical pharmacist, dietician, and PN nurse.

5.2. The PN physician will make the final decision to accept the referrals and the prescriptions made by the team.

5.3. Both the intensive care services physician (ICS) and the clinical/PN pharmacist have the clinical privileges to access the ABACUS™ software, or (equivalently, RABET), to enter orders and prescriptions in the PN order sheet.

5.4. The PN nurse is responsible for assessing PN patients and coordinating with all team members of the PN service.

5.5. The PN Dietician is responsible for nutritional screening and assessment.

5.6. **The ICU physician's responsibilities include:**

5.6.1. Accept or reject referrals from the primary physician based on patient assessment, and follow up with the primary team.

5.6.2. Taking the decision for all medical issues related to PN patients.

5.6.3. Responsible for ordering and modifying PN prescriptions.

5.6.4. Attending the regular round of PN patients.

5.6.5. Take the final decision of weaning, stopping, and continuing PN.

5.6.6. Participate in the patient's family education about parenteral nutrition.

5.7. **PN nurse responsibilities:**

5.7.1. The PN nurse is responsible for receiving the referrals on Obi Mobile (0509342898) and coordinating with the ICU physician, PN dietician, and PN clinical pharmacist.

5.7.2. The PN nurse is responsible for evaluating, assessing, and following PN patients on a daily basis during the weekdays.

5.7.3. The PN nurse is responsible for training and teaching registered nurses to deal with patients on PN.

5.7.4. The PN nurse is responsible for checking the IV line daily and helping with the dressing if needed.

5.7.5. The PN nurse is responsible for managing, coordinating, and leading the regular round for all PN patients.

5.7.6. The PN nurse is responsible for arranging the PN administration timing (when the patient is on cyclic PN) with the patient and the bedside nurse.

5.7.7. PN nurse actions and instructions should be documented in the PN progress note form.

5.7.8. Participate in the patient's family education about parenteral nutrition.

5.8. **PN clinical pharmacist responsibilities:**

5.8.1. Responsible for ordering and modifying PN prescriptions.

5.8.2. Participate with other PN team members for the patient's assessment.

5.8.3. Participate in the PN regular rounds and give recommendations for medications, electrolytes related to PN use, and evaluating the patient's response to parenteral nutrition.

5.8.4. Revision and approval of PN prescriptions prior to compounding in the pharmacy.

5.8.5. Participate in re-designing the PN-related forms and prescriptions, ordering, documentation, and follow-up.

5.8.6. Participate in the patient's family education about parenteral nutrition.

5.9. **PN clinical dietician responsibilities:**

5.9.1. Responsible for performing an initial nutritional assessment that includes a definition of nutritional status and a determination of the patient's degree of stress.

5.9.2. Responsible for evaluating all patients referred to the PN team and estimating nutritional needs and requirements.

5.9.3. Responsible for macronutrient calculations in the PN prescription and for monitoring daily energy intake.

5.9.4. Responsible for monitoring each patient's nutritional status to ensure that changing metabolic needs are recognized and met.

5.9.5. The PN dietitian will help in the transition to enteral nutrition.

5.9.6. Participate in the patient's family education about parenteral nutrition.

5.10. **Registered Nurses (RNs):**

5.10.1. Responsible for administering and monitoring patients on PN.

5.10.2. Monitor and assess the IV line every 2 hours and document it in the daily nursing activity record.

5.10.3. Responsible to inform the PN pharmacist and IV pharmacy if the patient is discharged, deceased, or the PN is on hold as per the physician's order.

5.10.4. Two (2) RNs are responsible for:

5.10.4.1. Check the content of the PN bag; make sure it matches the PN content from the prescription. Any discrepancy should inform the PN nurse and PN clinical pharmacist.

5.10.4.2. Visual check of the PN solution (volume content, particles, clarity).

5.10.4.3. Review the rate of the PN and LIPID according to the PN volume.

5.10.4.4. Set the PN and lipid rate in the infusion pump according to the physician's PN order.

5.10.4.5. Prime the PN and lipid volume infused into the infusion pump.

6. POLICY

6.1 Parenteral nutrition should be prescribed either by an Intensive Care Services (ICS) physician or a clinical PN pharmacist.

6.2 Fluids and electrolytes should be corrected before starting PN.

6.3 Adult patients may receive PN either centrally or peripherally.

6.4 All 2 in 1 PN, IVFE, or MCB solutions must be prepared in the pharmacy, and no solutions or medications are to be added outside the pharmacy.

6.5 Two (2) trained registered nurses should administer parenteral nutrition to the patient using aseptic technique.

6.6 Parenteral nutrition can be started for all inpatients indicated for PN.

6.7 All PN orders should be written in accordance with the PN official PSMMC hospital-wide policy and Clinical Practice Guidelines (CPG).

7. PROCEDURES

7.1. Initial assessment.

7.1.1. A clinical examination, including vital signs and a thorough physical assessment, gives an important overall impression of health and includes the general appearance and activity level of the patient.

7.2. Laboratory assessment.

7.2.1. Laboratory data can be used as a marker of nutritional assessment.

7.2.2. Routine electrolytes (sodium, potassium, and chloride), minerals (calcium, phosphorus, and magnesium), bicarbonate, liver function test, lipid profile, serum

urea, and creatinine, along with CBC and PT/aPTT, help to determine the medical patient's status before initiating PN.

7.3. **PN preparation.**

7.3.1. All PN preparation should be prepared using aseptic technique of compounding sterile products (Refer to MCWPP No. 1-1-8062-05-022) and according to the PN Pharmacy Policy (Refer to Policy No. 1-2-7200-01-036).

7.3.2. All (2 in 1 PN), (MCB), and (IVFE) solutions must be prepared in the pharmacy.

7.4. **PN Ordering: (as per electronic system RABET or equivalent).**

7.4.1. The clinical/PN pharmacist and the critical care services physician (ICS) both have the clinical privileges to access the ABACUS™ software, or (equivalently, RABET), to enter orders and prescriptions in the PN order sheet.

7.4.2. Orders should be double-checked before submission. Always enter the adult patient amount per day.

7.4.3. In the event of an emergency power outage or intranet interruptions, PN should be ordered via the PN order sheet (paper prescription).

7.4.4. PN orders should be written in accordance with the PN official PSMMC hospital-wide policy and Clinical Practice Guidelines (CPG).

7.5. **PN Administration.**

7.5.1. Parenteral nutrition should be approved by the adult PN team.

7.5.2. Two (2) trained registered nurses should administer parenteral nutrition (as high-alert medication) to the patient under aseptic technique (see also HWP of high-alert medication No. 1-1-8062-05-020).

7.5.3. Two (2) trained registered nurses should check the rate and volume of the infusion pump.

7.5.4. PN can be started in all admitted patients.

7.5.5. PN needs to be administered via a central line; this is necessary to meet the full nutritional needs.

7.5.6. Peripheral line access (18G or above) may be acceptable to provide partial parenteral nutrition for a period of 5 days, then need to be shifted to a central line or as per the physician's responsibility.

7.5.7. The peripheral line should be changed as a protocol.

7.5.8. The osmolarity of PN administered to adult patients through the peripheral line needs not to exceed 900 mOsmol/L.

7.5.9. PN with high osmolarity infused through a peripheral line may result in complications including pain, extravasations, infiltration, and phlebitis.

7.5.10. In the event of an IV line-related complication, the primary nurse must implement the following:

- 7.5.10.1. Stop parenteral nutrition immediately.
- 7.5.10.2. Inform the physician and PN team.
- 7.5.10.3. Complete documentation.
- 7.5.10.4. Management as extravasation policy (Appendix A).
- 7.5.10.5. IV sets have to be replaced daily, and disposal filters have to be used for each bag.

7.5.11. A 2-in-1 PN bag must be stored in the refrigerator at a temperature between 2 and 8 degrees and kept at room temperature for 1 hour prior to administration. IVFE bag must be stored at room temperature (less than 25 degrees).

7.5.12. A 2-in-1 PN bag should not be exposed to heat or sunlight.

7.5.13. IVFE is not to be exposed to heat.

7.5.14. New sterile IV tubing and an in-line filter 0.2 micron specific for 2 in 1 PN solution are used with every new 2 in 1 PN bag. Adherence to aseptic technique and standard precautions are vital.

7.5.15. The hanging time of IVFE should not exceed 12 hours.

7.5.16. Hang time of 2 in 1 PN should not exceed 24 hours.

7.5.17. No new prescription for PN will be accepted by the pharmacy after 1030 Hrs.

7.6. **Monitoring**

7.6.1. Blood sugar for non-diabetic ward patients should be monitored every 6 hours. For diabetic patients who are on sliding-scale insulin and patients with unstable physiology, their blood sugar should be monitored every 4 hours.

7.6.2. Vital signs every 6 hours or as per the policy of the area.

7.6.3. Strict intake and output chart for all the patients.

7.6.4. Daily weight is to be done at 1800 Hrs.

7.6.5. Blood tests should be performed three times a week. (Sunday, Tuesday, and Thursday) These tests, as per the PN protocol (CBC, PT, PTT, Mg, Cl, P04, Ca, Bicarb, ALP, ALT, AST, Creatinine TBIL, Na, K, Urea, Phos, and Albumin), are to be labeled urgent to be sent at 0400 Hrs.

7.6.6. Twenty-four (24) hours urine collection of urea to be sent once weekly at 0600Hrs.

7.6.7. The collection of blood for serum zinc, transferrin, pre-albumin, and lipid profile should be done weekly for new patients on PN and monthly for chronic patients.

7.6.8. Daily laboratory monitoring may be required for critically ill patients, those at risk of refeeding syndrome, patients transitioning between PN and enteral feeding, or those who have experienced complications associated with nutritional therapy.

7.6.9. The peripheral line should be checked regularly for peripheral TPN as per protocol.

Parameter	Baseline	Initiation	Critically Ill	Stable Inpatient	Stable Home
Serum chemistries (Na, K, Cl, CO_2, serum urea nitrogen, creatinine, ionized calcium,[a] magnesium, phosphorus, serum glucose)	Yes	Daily for 3 consecutive days	Daily	1–2 times per week	Every other week for 1–3 months, then every month and as needed
ALT, AST, ALP, total bilirubin	Yes	Day 1	Weekly	Monthly	Same schedule as serum chemistries
Serum triglycerides	Yes	Day 1	Weekly	Weekly	Every other week for 1–3 months, then monthly, therapy >6 months every 6–12 months
CBC with differential	Yes		Weekly	Weekly	As needed
Weight	Yes	Daily	Daily	2–3 times per week	Daily, same time and same scale until fluid status stable, then weekly to monthly
Intake and output	Yes	Daily	Daily	Daily unless fluid status assessed via physical examination	
INR, PT	Yes	Day 1	Weekly	As needed	As needed
Capillary glucose[b,c]		As needed	Every 1–6 hours	As needed	When ill or at risk of glucose intolerance
Nitrogen balance	As needed		As needed	As needed	As needed

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7.7. Stopping the PN solution.

7.7.1. A ward dietitian should be consulted before stopping the PN.

7.7.2. PN is to be stopped if enteral feeding is around 65%–70% of the daily calorie requirements.

7.7.3. PN must not be stopped abruptly, and it should be tapered off as follows:

7.7.3.1. Check blood sugar as follows: before starting to taper, then every 30 minutes for one hour, then hourly for one hour.

7.7.3.2. The PN rate of infusion decreased by 25% of the initial rate every 30 minutes.

7.7.4. Flushing with 10 ml of normal saline (0.9% NaCl) is recommended for any change or after stopping (PN) or (IVFE) solutions.

7.7.5. Patients can be transferred with the PN solution, and the PN nurse must be informed of any transfer of patients from one area to another.

7.7.6. If the patient is booked for any procedures, e.g., Operating room, MRI, etc., PN must be tapered 2 hours prior to the procedure.

7.7.7. IVFE can be stopped abruptly, and there is no need for infusion tapering.

7.7.8. In case of any PN-related complication or stopping, refer all concerns to the PN nurse during working hours and after office hours to the on-call ICS physician, PN pharmacist.

7.7.9. Never reconnect PN or IVFE solutions, as this is considered a risk of bloodstream infection.

7.7.10. In case of sudden stops for the PN for any reason, commence administration of 10% dextrose via peripheral line or another venous access device (VAD) at the same rate. Continue the administration of 10% dextrose until the next due PN solution administration time.

7.7.11. In the event that the patient will be discontinued from PN, dextrose 10% should be given for 4 hours from the time of the abrupt withdrawal or until the blood sugar level is within the normal limit

7.7.12. Inform the PN nurse of any stoppage of the PN.

7.7.13. Monitor blood glucose hourly for 2 hours, then every 4 hours (risk of hypoglycemia).

7.7.14. It is the responsibility of the primary nurse to inform the PN nurse, PN pharmacist, and IV room in the pharmacy if the patient has discharged or expired, or if the doctor has ordered to hold the PN

7.8. **PN Safety Measures.**

7.8.1. The PN mixture needs to be protected from light to prevent oxidant production.

7.8.2. Heparin can be added to PN solutions to ensure line patency; it is especially needed for central lines and peripheral lines according to clinical status.

7.8.3. Some medications can be added to PN in coordination with the clinical PN pharmacist according to stability. (e.g., L-carnitine, thiamine, insulin, heparin, granisetron, selenium, etc.)

7.8.4. Extravasation could have happened when receiving parenteral nutrition vperipheral line, unless it did not exceed the osmolality of 900 mOsm, Extravasation management (refer to Vasoactive IV Drops Policy No. 1-2-7200-01-042).

7.8.5. Two registered nurses have to double-check the contents of the PN bag received and make sure it matches the PN order. If not, contact the PN nurse in charge and/or the prescribing physician or PN clinical pharmacist on-call.

7.8.6. Two (2) trained registered nurses should administer parenteral nutrition to the patient under strict aseptic technique.

7.9. **PN Prescribing.**

7.9.1. ABACUS™ software or (equivalent RABET system) will be installed in all PSMMC critical areas to enable the application of electronic prescriptions to allow early detection and minimizing of PN prescribing mistakes and errors and to allow nurses to check PN bag labels against PN prescriptions. (Refer to HWP Policy No. 1-2-720001-036.)

7.9.2. In case of emergency electricity or intranet shutdown, PN needs to be ordered via the PN order sheet (paper prescription) and/or Abacus (or equivalent software system) entry system.

7.9.3. Orders should be double-checked before submission. Always enter the adult patient amount per day

7.10. **PN Fluid requirements.**

7.10.1. Many calculations can be used for calculating maintenance fluid.

7.10.2. Fluid requirements can be individualized according to the patient's condition.

Method to calculate fluid		
ml per kg	>65 years 55-65 y/o 30-55 y/o 15-30 y/o	25ml/kg fluid 30ml/kg fluid 35 ml/kg 40 ml/kg
Holliday – segar	<10 kg 10-20 kg 20 kg	100ml/kg 1000 ml +50 ml/kg for every kg (10-20) 1500 ml +20ml/kg for every kg >20kg
4-2-1 rule	< 10 kg 10-20 kg 20 g	4ml/kg/hr 40ml/hr+2ml/kg/hr for every kg (10-20) 60ml/hr+1ml/hr for every kg >20 kg

7.11. **PN Calories requirements:**

Caloric distribution (if protein is considered for calories) is recommended as follows: (**55% to 70% total calories** from Dextrose), (**20% to 30% total calories** from lipids), and (**10% to 15% total calories** from protein). This improves protein accretion, minimizes energy expenditure, and approximates the enteral` feeding range

7.12. **Central Venous Catheters (CVC) Care.**

7.12.1. The line should be for PN use only and strictly cannot be used for administration of any other solutions or medications or blood drowning.

7.12.2. PN will not be initiated until the correct placement of the CVC is verified.

7.12.3. A double-lumen catheter is always recommended for PN administration.

7.12.4. It is recommended that the biggest port of the central line be used only for the IVFE solution and the other port for 2 in 1 PN only.

7.12.5. Only 2% chlorhexidine-based or its equivalent is used for:

7.12.5.1. Patient skin disinfection.

7.12.5.2. Exit site dressing change and.

7.12.5.3. VAD lumen access preparation.

7.12.6. Transparent dressing is recommended.

7.12.7. The VAD site dressing must be changed every 7 days, or as indicated, when the dressing becomes soiled, wet, or non-occlusive.

7.12.8. Gauze with a semi-permeable moisture vapor dressing is recommended for patients who have chronic oozing from the site, bleeding, or are diaphoretic. Dressing is to be changed every 24 hours.

7.12.9. For tunneled VAD, to remove the sutures from the entry site after 7 days after line insertion and uncovered without any dressing after 14 days of being dressed.

7.12.10. Any VAD removal requires a doctor's approval.

7.12.11. Registered nurses are allowed to remove non-tunneled VAD. This requires a physician's order.

7.12.12. All tunneled VADs can only be removed by a physician.

7.12.13. If the patient's temperature is more than 38°C, a swab for C/S from the VAD insertion site is required, and a blood culture is required from blood from the PN VAD lumen and peripheral site.

7.12.14. In the case of cyclic, PN Taurolidine with heparin or an equivalent antiseptic lock solution can be used to prevent CLABSI.

8. APPENDICES

Extravasation policy (Appendix A)

9. REFERENCES

9.1. ASPEN recommendation 2019

9.2. ASPEN Safe Practice for Parenteral Nutrition 2014.

9.3. ESPEN Guideline on Parenteral Nutrition Central Venous Catheters

10. CONTRIBUTING DEPARTMENT/S

10.1. Pharmaceutical Department.
10.2. Intensive Care Services Department.
10.3. Executive Nursing Affairs.
10.4. Nutrition Department

Compiled by: • **Mastourah Al Otaibi** **PN clinical Pharmacist**	**Signature:**	**Date:** 16/10/2023
• **Hossam Tawakol Mohamed** **PN Clinical Pharmacist**		16/10/23
• **Rabaa Al Huthail** **PN Dietician**	**Signature:**	**Date:** 16/10/2023
• **Fadiah Kariri** **PN Charge Nurse**	**Signature:**	**Date:** 17/10/2023
• **Dr.Faisal Al Yahya** **Head, Parenteral Nutrition Division, ICS**	**Signature:** Faisal	**Date:** 17 Oct 2023
Reviewed by: • **Dr.Muhammad Kashif Malik** **Consultant & Head, CQI&PS Division, Intensive Care Services**	**Signature:**	**Date:** 16 Oct 2023
• **Nursing Policy, Procedure and Guidelines Committee**	**Signature:**	**Date:** 23.10.2023
• **Raneem Al Madani** **Head of Dietetics Department**	**Signature:**	**Date:** 25.10.2023
Reviewed by: **Brig. Gen. Dr Bander Al Harbi** **Director of Pharmaceutical Services Department**	**Signature:**	**Date:** 19/10/2023
Reviewed by: **Dr. Turki Al Mutairi** **Executive Director of Nursing Affairs**	**Signature:**	**Date:** 22/10/23
Reviewed by: **Brig. Gen. Dr. Abdulelah Mohammed Hummadi** **Director, Continuous Quality Improvement & Patient Safety (CQI&PS)**	**Signature:**	**Date:** 24/10/2023
Authorized by: **Brig. Gen. Dr Adnan Al Ghamdi** **Director, Intensive Care Services**	**Signature:**	**Date:** 16 Oct 2023
Authorized by: **Brig. Gen. Dr. Abdulrahman Al Robayyan** **Director of Medical Administration**	**Signature:**	**Date:** 25/10/2023
Approved by: **Maj. Gen. Khalid Abdullah Al Hudaithi** **General Executive Director of Prince Sultan Military Medical City**	**Signature:**	**Date:** 26/10/2023

APPENDIX 1

Extravasation is the leakage of vesicants that can cause blistering and tissue necrosis. It can result in severe injury with subsequent functional impairment and residual cosmetic defects.

Prevention of extravasation

1. Use the appropriate dilution and rate of administration.
2. Properly place and locate IV sites (i.e., avoid extremities with poor venous circulation).
3. Properly splint the extremity while an IV cannula is in place to immobilize the extremity without constriction and prevent the cannula from tearing or eroding through the vessel.
4. Monitor carefully and frequently solutions administered by infusion pumps (at least hourly, and every few minutes during the infusion of irritating drugs).
5. Use transparent dressings and clear tape to allow inspection of the injection site.
6. Assess for pain during and after infusions

I. Non- pharmacologic management of extravasation

1. Stop and disconnect infusion; do not remove the cannula or needle
2. Gently aspirate as much extravasated agent as possible; avoid manual pressure
3. Remove cannula or needle
4. Elevate affected limb
5. Apply warm compresses 20 minutes 3 or 4 times daily for the first 2 or 3 days
6. Monitor and consider the need for surgical management such as surgical flushing with normal saline or debridement and excision of necrotic tissue (especially if pain persists for 1 to 2 weeks)

II. Pharmacological management of extravasation

Management	Comment
1. Phentolamine 5 to 10 mg in 10 to 20 mL NS, give multiple intradermal injections across extravasation site	**1.** A syringe with a fine hypodermic needle should be used and the solution infiltrated liberally throughout the area of extravasation (easily identified as having a cold, hard, pallid appearance) **2.** Treatment of choice; may re-dose if patient remains symptomatic
2. Elevation, heat therapy near injection site	**3.** Adjunct treatments
3. Avoid ice packs, conivaptan, and hyaluronidase	**4.** May worsen vasoconstriction