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PREFACE

Madam A’lia binti Hashim
Director of Pharmacy Practice & Development Division,
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As pharmacists, we see the increase in demands for Home Parenteral Nutrition in the recent years and this has triggered the call to develop a standard way of delivering this newly evolved and specialised service. Pharmacy Practice & Development Division is continuously and proactively looking into areas that need improvement and expansion. This guideline on Home Parenteral Nutrition is established to ensure provision of quality services to the patients. I am certain that the content is up to date, applicable and meets the relevant standards. Our goal is to create equal access to the patients who are more dependent on parenteral nutrition supply but access to the local centre are rendered difficult or impossible.

The recommendations in this guideline are made by taking into considerations on the pharmacy service policies, the fulfillments of patients need, workflow and requirements. This guideline also provides sufficient background of home parenteral nutrition service beyond the pharmacists’ scope as additional knowledge for pharmacist. After all, this service can only be achieved with the contributions of multiple disciplinary healthcare provider involvements.

I am very obliged to see this guideline move forward in this edition and very grateful for everyone that has directly or indirectly contributed to the success of the publication of this document. I sincerely hope that this guideline will benefit pharmacists involved in Parenteral Nutrition service. I would also like to take this opportunity to congratulate and express my appreciation to the Clinical Pharmacy Subcommittee (Parenteral Nutrition Subspecialty) for their tireless efforts in producing this important guide.
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*HPN: HOME PARENTERAL NUTRITION
1. INTRODUCTION

Home Parenteral Nutrition (HPN) refers to a long-term provision of parenteral nutrition to patients within their own homes. This mode of nutritional support is vital for patients with chronic intestinal failure whose nutritional needs cannot be met orally or enterally. The most prominent benefits of HPN are improvement of patients’ well-being and overall quality of life, reduction of length of hospital stay and alleviation of patients’ stress. Studies had showed the overall 5-year survival for HPN patients with benign disease is about 75% depending on the underlying disease, patient’s age and gut anatomy. Other positive factors that influenced quality of life are young patients, longer treatment duration, high self-esteem, a good relationship with a partner, wealth and employment. In addition, economic analysis showed that HPN treatment is also less costly from healthcare provider perspective, contrary to the cost of hospitalisation.

HPN service is a Multidisciplinary Team (MDT) approach with Nutrition Support Team (NST)/ Nutrition Therapy Team (NTT) as the backbone in providing holistic patient’s care. NST consists of surgeon/physician, Parenteral Nutrition (PN) pharmacist, dietitian, trained nurse and medical social officer who are responsible in managing HPN patient. This team does not only monitor clinical outcomes and HPN complications, it also provides information on appropriate home environment for HPN candidate, manages supply of parenteral nutrition product as well as giving education and training to HPN patient/ caregiver.

In Malaysia, HPN was first reported by Chang and Tan in year 1994 whereby two adult cases of short bowel syndrome were treated with HPN. It is still relatively new in Malaysia and rarely reported. The two most prominent hospitals that are actively involved in handling HPN cases are Hospital Kuala Lumpur and Hospital Sungai Buloh. Both of the hospitals become the main source of references for the initiation of HPN programme in other MOH facilities. Nutrition Therapy Team (NTT) of Hospital Sungai Buloh have managed 16 cases from year 2015 ever since the establishment of HPN service in its facility while Hospital Kuala Lumpur had managed 12 HPN patients since year 2006. The biggest challenge in treating HPN patient is none other than provision of conducive environment and psychosocial support from the caregivers.
This guideline is an initiative of Clinical Pharmacy Working Subcommittee (Parenteral Nutrition Subspecialty) intended to assist and provide support as well as recommendations for pharmacists in delivering HPN service effectively in MOH facilities.

2. OBJECTIVES OF HPN PHARMACY SERVICE

The prime objectives of HPN pharmacy service are to promote positive clinical outcome of an illness and improve patients’ quality of life by four fundamental steps:
2.1 Identify nutrition goals
2.2 Determination of nutrient requirements to achieve nutrition goals
2.3 Delivery of the required nutrients
2.4 Subsequent assessment of the nutrition regimens

3. SCOPE OF HPN PHARMACY SERVICE

3.1. The HPN service can ONLY be initiated by hospital with Parenteral Nutrition Service.
3.2. Subsequent supply of HPN can be done by the same hospital or other hospital with PN Service. Referring HPN patient to another hospital shall be done after discussing with NST/MDT of that hospital.
3.3. Other health facilities (hospital or health clinic) may assist in conducting monitoring (anthropometric, vital sign and biochemistry monitoring) or managing wound care.
4. MANPOWER REQUIREMENT

4.1. To start HPN service in hospital setting, it is highly recommended to have the expertise of NST and each NST member have roles and responsibilities in managing HPN patient.

4.2. For pharmacy, it is essential to have trained pharmacist in Parenteral Nutrition to assist patient technically and clinically.

5. STANDARD OPERATION PROCEDURES FOR INITIATING HPN

5.1. Recruitment of HPN patient

Upon selecting patient to HPN programme, patient screening shall be done by NST/ MDT. This is followed by education and training sessions which shall be conducted in parallel with patient assessment and patient’s home/ facility assessment.

5.1.1. Patient Selection

Patients are identified by the NST/ MDT and usually, the decision will be made by the attending surgeon/ physician to start patient on HPN. *(Refer Appendix I: Patient Selection Criteria)*

5.1.2. Patient Screening

NST/ MDT shall screen patient for HPN programme using the criteria below:

i. Diagnosis and indication for HPN
ii. Medical status and co-morbidities
iii. Nutrition status and nutrition support
iv. Parenteral nutrition regimen
v. Welfare aspects and logistics

5.1.3. Education and Training Sessions for Patient and Caregiver

Patient and caregivers shall be given education and training sessions by NST/ MDT. Education and training are vital in HPN programme to enable patient/ caregiver to manage HPN on their own at their home settings. *(Refer Appendix II: Education and Training Sessions)*
5.1.4. **Home/ Facility Assessment**
NST/ MDT shall also visit patient’s home/ facility to assess home environment, medical suitability, rehabilitation potential and all the costs involved in the HPN programme. The assessment shall be done prior to patient discharge from the hospital. *(Refer Appendix III: Suitable Home Environment)*

5.1.5. **Patient Assessment**
Assessments on patient’s/ caregiver’s knowledge and aseptic techniques shall be done by NST/ MDT. These assessments shall be performed before patient discharge.

5.1.6. **HPN Approval and Patient Consent**
i. Patient who fulfils all the criteria, shall be recruited to HPN programme. NST/ MDT shall then get consent from patient/ caregiver whether they are willing to participate in HPN programme and agreeable to all conditions that had been discussed by the team. *(Refer Appendix V: Assessment Checklist of Home Parenteral Nutrition Training)*

5.1.7. **Treatment Plan**
NST/ MDT shall create a patient’s treatment plan prior to patient discharge from the hospital and the treatment plan shall contain:
   i. Appointment date/ schedule
   ii. Parenteral nutrition regimen
   iii. Daily nutrition log
   iv. Handling emergency situation and who to contact
FLOW CHART 1: RECRUITING PATIENT FOR HPN PROGRAMME

START

Receive request

Screen for clinical eligibility

Eligible?

YES

Assess home/facility

Educate & train patient

Assess patient

Qualified

NO

END

YES

Obtain HPN approval

Obtain patient consent

Execute treatment plan

Discharge patient

END
5.2 Pharmacy Procedures in HPN Programme

5.2.1 Formulate HPN Regimen
Pharmacist together with NST/ MDT shall screen patient and formulate appropriate HPN regimen based on patient’s nutritional requirements.

5.2.2 Compound HPN bag
i. Compounding of the preparations must be done under aseptic techniques, in line with the standards set in Good Compounding Practice and Manual for Sterile Preparations.
ii. Stability of HPN bag should be checked and preferably for longer expiry date.
iii. When necessary, electrolytes and micronutrients (multivitamin and trace elements) shall be added to HPN formulation based on patient’s clinical status. Additional fluids and electrolytes may be required in patients with significant gastrointestinal losses.
iv. Parenteral nutrition shall be administered intermittently over shorter periods, between 8-18 hours. This technique also known as cyclical infusion which improves patient’s quality of life and minimises metabolic complications.

5.2.3 Counselling and Teaching on HPN
Patient and caregiver shall be given counselling on HPN. The counselling and teaching sessions are recommended to be carried out in an in-patient setting that ensure patient’s privacy prior to discharge. For content of counselling sessions, refer to Appendix IV: Counselling and Teaching Sessions.

5.2.4 Delivering and storage of HPN
i. All PN bags intended for HPN patient shall be dispensed by PN pharmacist.
ii. The supply frequency of HPN shall be subjected to formulation stability as well as logistic convenience.
iii. Most PN bags are stable for 6 days in the fridge at temperature of 2 - 8°C and 24 hours at room temperature during infusion.
iv. Patient needs to have sufficient supply of consumable items in order to safely administer PN. (Refer Appendix VI: Equipment & Consumables)
v. It is essential to ensure cold chain mechanism is maintained during transport of PN bags from healthcare centre to patient’s home/facility. Hence it is mandatory that a suitable size cooler box is used for the storage and transportation of PN bags.

vi. There shall be a dedicated refrigerator for storage of PN bags at patient’s home/facility to avoid cross contamination of PN products with other household items. A proper thermometer should be used for temperature monitoring to ensure the preparations are stored in an appropriate temperature range (2 - 8°C).

5.2.5 Monitoring
i. Regular monitoring of HPN patient is important to ensure optimal nutritional intake, assess treatment response, improve quality of life and minimise complications.

ii. Patient should also be monitored for aluminium toxicity based on clinical presentation, bone density and liver status periodically.

iii. Apart from laboratory monitoring, the team should assess patient’s clinical presentation that may be suggestive of any complications.

iv. All the parameters mentioned in table in Appendix VII: Monitoring for HPN Patient shall be monitored during follow-up visit in hospital.

5.3. Regular Follow Up and Review of HPN Patient

5.3.1. NST/MDT shall be responsible in identifying the need for longer HPN treatment, planning the introduction and advancement of enteral or oral nutrition when necessary.

5.3.2. HPN patients shall be seen on a regular basis at home or in the hospital to review clinical outcomes, nutrition status and monitor PN complications.

5.3.3. Subsequent follow up appointment will be determined by the NST/MDT.

5.3.4. Periodic home visit shall be planned and conducted with NST/MDT.

5.3.5. Patient’s blood results, clinical and nutritional outcome shall be reviewed by a dedicated physician together with NST/MDT. The
latest HPN shall be formulated based on latest requirements for subsequent supply.

5.4. Handling of Emergency during HPN

5.4.1. The patient shall be referred to a physician in any clinically dangerous situations.

5.4.2. If the patient is having fever or suspected sepsis, the patient shall be sent to a nearby hospital emergency department directly. NST/MDT involved in managing the HPN patient shall be notified immediately regarding current status.

5.4.3. Any issues related to HPN bags, administration set or infusion pump shall be informed to NST/MDT or dedicated pharmacist immediately.

5.5. Documentation

5.5.1. HPN patient registry should be available to record demographic, laboratory and clinical findings (CP2: Pharmacotherapy Review Form) and PN formulation. It is highly recommended to provide patient with HPN diary chart. (Refer Appendix VIII: Daily Nutrition Log)

5.5.2. All counselling sessions on HPN should be documented and kept together with patient profile.
FLOW CHART 2: FOLLOW UP HPN PATIENT

RESPONSIBILITY

Doctor

Follow up patient at home/hospital

Doctor

Request HPN

Pharmacist

Review patient & screen HPN request

Pharmacist/Pharmacist Assistant

Intervention

Pharmacist/Pharmacist Assistant

Compound HPN

Pharmacist/Pharmacist Assistant

Dispense HPN

END

YES

NO
6. DISPOSAL OF HPN WASTE

6.1. Patient/ caregiver shall be advised to return the unused HPN bag to the pharmacy department.
6.2. Patient/ caregiver shall dispose the used sharp items such as needles and infusion set in a sharps bin or a properly closed lid container or return to hospital for safe disposal (based on facility policy).
6.3. Non-sharp used items shall be disposed into general waste bin.

7. EQUIPMENT AND CONSUMABLES

7.1. Supply of equipment and consumables shall be discussed with patient/ caregiver before initiating HPN. Both parties should agree with the plan and it should be documented.
7.2. Some of equipment and consumables shall be supplied to patients based on MOH facility policies and agreement while some other items will require patients to purchase or rent by themselves. The list of supply and non-supply items by MOH facility shall be documented.
7.3. Patient may consult medical social officer at the hospital for financial or other support related to HPN.
7.4. Essentials items required during HPN therapy are listed in Appendix VI: Equipment & Consumables.

8. COSTS INCURRED

8.1. HPN is an expensive but relatively cost-effective therapy. Equipment needed and the parenteral nutrition itself make up most of the cost incurred.
8.2. All costs expected to be incurred during the therapy should be discussed among the multidisciplinary team and patient or caregiver themselves.
8.3. If necessary, patient should be referred to medical social officer at the hospital.
REFERENCES


8. Association of the Scientific Medical Societies in Germany. Organization, regulations, preparation and logistics of parenteral nutrition in hospitals and homes; the role of the nutrition support team - Guidelines on Parenteral Nutrition, Chapter 8 GMS German Medical Science - An Interdisciplinary Journal.

Appendix I

PATIENT SELECTION CRITERIA

A) Common diagnosis

Long term HPN is indicated for patients with chronic intestinal failure (IF) that prevents the absorption of adequate nutrients to sustain life. Table 1 below shows some of the common diagnosis and underlying conditions in patients with chronic intestinal failure.\textsuperscript{1,3,7}

Table 1 Common diagnoses and underlying conditions in chronic intestinal failure.\textsuperscript{7}

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Underlying conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short bowel syndrome</td>
<td>Volvulus</td>
</tr>
<tr>
<td></td>
<td>Mesenteric vascular disease</td>
</tr>
<tr>
<td></td>
<td>Mesenteric tumours</td>
</tr>
<tr>
<td></td>
<td>Crohn’s disease</td>
</tr>
<tr>
<td>Radiation enteritis</td>
<td>Neoplastic disease</td>
</tr>
<tr>
<td>Chronic intestinal obstruction</td>
<td>Diffuse intra-abdominal adhesions or certain malignancies</td>
</tr>
<tr>
<td>Intestinal pseudo-obstruction</td>
<td>Enteric neuropathies or myopathies</td>
</tr>
<tr>
<td></td>
<td>Secondary amyloidosis</td>
</tr>
<tr>
<td>Chronic intestinal fistulae</td>
<td>Crohn’s disease</td>
</tr>
<tr>
<td></td>
<td>Adhesive bowel disease</td>
</tr>
<tr>
<td></td>
<td>Malignancy</td>
</tr>
</tbody>
</table>

B) Specific criteria for cancer candidate

Nonetheless, the decision to start HPN for the incurable cancer patients is rather controversial, even though the risk of malnutrition and death is high due to unmet nutritional needs.\textsuperscript{1,2}

It is generally recommended for patients with malignant obstruction or partial obstruction of the gastrointestinal tract given that there is no severe organ dysfunction that may significantly complicate treatment with PN.
Typical candidates for HPN have the following characteristics:

i) Little/no oral intake

ii) Inadequate gastrointestinal absorption

iii) No severe or uncontrolled symptoms

iv) Normal function of vital organs except gastrointestinal tract

v) Reasonable performance capacity

C) Other criteria

Some of other criteria that should also be considered:

i) Documented intestinal failure (IF) despite maximal medical therapy and would lead to deteriorating nutrition and/or fluid status.

ii) In cases of short bowel syndrome, patients should first have undergone a trial of enteral nutrition.

iii) Patients with documented IF should be assessed by a physician and/or multidisciplinary group with an expertise with IF.

iv) Patient and/or caregivers must be able to cooperate with therapy as well as physically and emotionally able to undertake HPN training.

v) Appropriateness of the domestic situation such as distance, environment and family support.

vi) Awareness on the diagnosis and likely prognosis.

vii) Quality of life.

viii) End-of-life issues.

Appendix II

EDUCATION AND TRAINING SESSIONS

A) Scope of education and training
The importance of educating the patients and their caregiver on the right way to manage HPN are aimed to minimise catheter-related and other complications that could arise. It should encompass comprehensive understanding related to aseptic technique (hand washing, gloving & infusion), pharmaceutical management (PN supply, storage, disposal & handling), catheter and line management, infusion pump management, cold-chain management, pre and post infusion management, complications management (preventing & recognising) and needle prick prevention.

B) Method and tools
Different methods of training such as written handouts, manuals and videos or internet links can be useful in the training of patients for HPN. The training can involve multiple patients, team members and relatives. It is of key importance however that only designated members of staff perform the training and that procedures used are consistent at all time. A checklist of the training is useful to check patient skills and technique.

C) Duration of education and training
Training for HPN is usually carried out in an in-patient setting prior to discharge. No time limits for training should be set as this allow patients or caregivers to make progress at their individual pace. Patient receiving HPN must be well trained and able to comply with procedure before discharge.

D) Monitoring and assessment
Patients on HPN must be monitored or reviewed and the aseptic technique must be re-assessed on a regular basis (e.g. at least once a year) by the multidisciplinary team (ideally a doctor, pharmacist, dietitian and nurse). The HPN monitoring should include a written record of the assessment and outcomes, which becomes part of the patient’s permanent medical record. Adjustments to therapy should also be part of the medical record.
E) Basic aseptic technique

i) Hand washing

1. Rub hands palm to palm,
   right palm over left
dorsum with interlaced
fingers and vice versa,
2. palm to palm with
   fingers interlaced,
3. backs of fingers to
   opposing palms with
   fingers interlocked,
4. rotational rubbing of left
   thumb clasped in right
   palm and vice versa,
5. rotational rubbing of left
   thumb clasped in right
   palm and vice versa,
6. rotational rubbing of right
   wrist clasped in left palm
   and vice versa

ii) Gloving

1. Pick up one glove with thumb
   and forefinger
2. Pull glove on hand
3. Slip partially gloved hand
   under cuff of second glove
4. Pull second glove over other
   hand and pull glove up to
   gowned wrist
5. Slip fingers of completely gloved
   hand under cuff of first hand, pull
   glove to gowned wrist
6. Gloving procedure complete
Appendix III

SUITABLE HOME ENVIRONMENT

A) Home environment

A proper home environment is essential to provide safe therapy and avoid infection or other complications. Home environment should be stable, safe, relatively clean and meet certain physical requirements.

B) Facilities

HPN therapy requires refrigeration of the solution and maintenance of a sterile environment during catheter care and PN administration. If the home does not have electricity, running water or a telephone, alternative plans may need to be explored. For example, limited telephone service for medical emergencies can be arranged through the local telephone company, or power can be restored under special funds available for patients receiving life-supporting therapies.

C) Alternative

Alternative plans shall be carried out if certain conditions of the home are deemed unsafe or inappropriate for the therapy.

D) Specific criteria

Some of the criteria of facilities requirement are as below:

i) A dedicated clean area for PN infusion (preferably free from household traffic or other distractions).

ii) Room temperature is maintained at 20 - 25°C with good aeration, either by using fan or air-conditioner.

iii) Source of electric supply such as electric socket.

iv) Elbow sink tap or hand-washing area (near to PN infusion room).

v) Dedicated storage space (2 - 8°C refrigerator) for PN mixture, disposables and other equipment.

vi) Source of communication (telephone).
COUNSELLING AND TEACHING SESSIONS

The content of the counselling sessions may include:

A) General information on HPN

i) The implication and goals of HPN treatment.
iii) Possible complications including metabolic and electrolytes imbalances, PN induced toxicities and infections caused by failure in catheter care.
iv) How to troubleshoot or who to contact if any of the complications arise.

B) Other information

i) Education and training on aseptic technique, pharmaceutical management, catheter and line management, and other HPN-related management shall be provided to patient/ caregiver.
ii) Patient and caregiver shall be monitored and assessed on aseptic technique and other HPN-related management prior to discharge.
iii) Written and verbal information regarding HPN treatment should be given to patient/ caregiver.

C) Other pharmaceutical information

i) Compounded PN preparations shall be stored at 2°C to 8°C.
ii) Visual inspection of PN products shall be carried out prior to administration.
iii) PN should be administered 30 minutes after taken out from the refrigerator.
iv) Vitamins and trace elements should be added when necessary.
# ASSESSMENT CHECKLIST OF HOME PARENTERAL NUTRITION TRAINING

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Catheter care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Complications of parenteral nutrition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Storage and handling of parenteral nutrition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Infusion pump use and care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Conditions/situations that need to seek medical attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Practical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Catheter care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hand washing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Gloving technique</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Set up dressing table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Aseptic technique</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Addition of vitamins &amp; trace elements (where appropriate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Parenteral nutrition administration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Handling of infusion pump</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Disconnect parenteral nutrition administration set</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Storage of parenteral nutrition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Disposal of consumables and unused PN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** This assessment list to be used prior to discharge. Mark (%) when patient/caregiver fully understood the topic explained. Patient/caregiver should understand all descriptions before initiation of Home PN.

**Remarks:**

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
**EQUIPMENT AND CONSUMABLES**

Table 2 Essential Items Required During HPN Treatment.

<table>
<thead>
<tr>
<th>No.</th>
<th>Essential items</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parenteral nutrition preparation</td>
<td>Hospital</td>
</tr>
<tr>
<td>2</td>
<td>Administration set</td>
<td>Hospital</td>
</tr>
<tr>
<td>3</td>
<td>Infusion filter</td>
<td>Hospital</td>
</tr>
<tr>
<td>4</td>
<td>Infusion pump</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>5</td>
<td>Refrigerator</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>6</td>
<td>Stainless steel trolley/ table</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>7</td>
<td>Drip stand</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>8</td>
<td>Elbow tap</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>9</td>
<td>Cooler box</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>10</td>
<td>Thermometer</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>11</td>
<td>Sharps bin</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>12</td>
<td>Disposable dressing set</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>13</td>
<td>IV line stopper</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>14</td>
<td>Sterile gloves</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>15</td>
<td>Alcohol swab</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>16</td>
<td>Sterile gauze</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>17</td>
<td>Micropore tape</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>17</td>
<td>Line flushing set (10ml syringes)</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>18</td>
<td>Normal saline 10ml</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>19</td>
<td>Surface disinfectant</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>20</td>
<td>Hand sanitiser</td>
<td>Patients purchase</td>
</tr>
<tr>
<td>21</td>
<td>Weighing Scale</td>
<td>Patients purchase</td>
</tr>
</tbody>
</table>

*Equipment and consumables are provided by the hospital based on the agreed decision between hospital management with patient and caregiver. Not all items that are provided by hospital, some of the costs must be borne by the patient himself. Patient may consult medical social officer to request for financial support/ other support related to HPN.*
PN Bag

Infusion filter

Refrigerator

Administration set

Infusion pump

Stainless steel trolley/table

Drip stand

Elbow tap

Cooler box

Thermometer

Sharps bin

Disposable dressing set
*Pictures attached are for illustration purposes only.*
MONITORING FOR HPN PATIENT

The objectives of regular monitoring of HPN are to

i) ensure optimal nutritional intake,
ii) assess treatment response,
iii) measure quality of life and
iv) minimise complications.\textsuperscript{1,9}

A) Clinical outcome

Patients on HPN shall be seen and re-assessed on a regular basis by the multidisciplinary team (optimally a doctor, pharmacist, nurse and dietitian). HPN regimens should be adjusted based on current parameters and nutritional requirements. Adjustment of the regimens should be documented.\textsuperscript{2,9}

Table 3 Suggested framework for assessment and monitoring (Adapted from AuSPEN 2008).\textsuperscript{9}

<table>
<thead>
<tr>
<th>Type of Monitoring</th>
<th>Parameters</th>
</tr>
</thead>
</table>
| Core monitoring    | • Weight and height.  
|                    | • Oral or enteral intake.  
|                    | • Biochemistry including electrolytes, glucose, urea, creatinine, liver function tests.  
|                    | • Haematology screening.  
|                    | • Longer-term patients should have lipid screening.  
|                    | • Magnesium, zinc, copper, manganese, selenium, and iron status.  
|                    | • Prescription/non-prescription medicines taken.  
|                    | • Extra renal losses (e.g., stoma losses) should be assessed for stability and adequate replacement planning.  
|                    | • Line status and adequacy of care.  
|                    | • Functional status. |
### Type of Monitoring

**Additional monitoring**

- Glycaemic monitoring.
- Bone density test once a year for the vulnerable groups including postmenopausal women.
- Quality of life survey.
- Body composition measurement, involving at least anthropometry (muscle mass and fat stores), to guide ongoing protein–energy prescribing.
- Inflammatory markers if there is an ongoing inflammatory disease.
- Problem solving checklists.
- International Normalised Ratio (INR) if patient on any anticoagulant.

*The time frame depends on the status of the patient and may range from weekly to every 6 months but commonly done for every 3 months.*

---

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry; electrolytes including magnesium, calcium &amp; phosphate, kidney function, liver function, glucose, full blood count, iron, albumin and C-reactive protein</td>
<td>During all visits / 3 monthly intervals</td>
</tr>
<tr>
<td>Lipid profile</td>
<td>During all visits / 3 monthly intervals</td>
</tr>
<tr>
<td>INR level if patients on anticoagulant</td>
<td>During all visits / 3 monthly intervals</td>
</tr>
<tr>
<td>Blood Glucose</td>
<td>During all visits / 3 monthly intervals</td>
</tr>
</tbody>
</table>

---

**B) Monitoring Complication due to HPN**

HPN associated complications that need close monitoring can be divided to short-term and long-term HPN administration.
Table 5 Short-term HPN administration complications.

<table>
<thead>
<tr>
<th>Complications</th>
<th>Cause</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydration</td>
<td>• High frequency bowel output</td>
<td>Postural hypotension, dry mucous membranes, decrease skin turgor, decrease volume of urine</td>
</tr>
<tr>
<td></td>
<td>• Inadequate fluid absorption</td>
<td></td>
</tr>
<tr>
<td>Fluid overload</td>
<td>• Excessive fluids</td>
<td>Swelling, short of breath while infusing, 0.9 kg weight gain within 2 days</td>
</tr>
<tr>
<td>Catheter malposition and thrombosis</td>
<td>• The catheter tip position dislodged and migrate</td>
<td>Facial swelling on one side, headache</td>
</tr>
<tr>
<td></td>
<td>• Lipid occlusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mineral precipitation</td>
<td></td>
</tr>
<tr>
<td>Catheter related infection</td>
<td>• Contamination of catheter tip</td>
<td>Fever, chills, sweating during HPN infusion, fatigue, redness or pain at catheter site</td>
</tr>
<tr>
<td></td>
<td>• Poorly done aseptic technique</td>
<td></td>
</tr>
<tr>
<td>Electrolyte abnormalities</td>
<td>• Excessive loss of free water</td>
<td>Increase serum sodium and chloride.</td>
</tr>
<tr>
<td></td>
<td>• Excessive intravascular free water accumulation</td>
<td>Decrease serum sodium and chloride, haemoglobin and haematocrit may decrease</td>
</tr>
<tr>
<td></td>
<td>(in liver disease and presence of ascites)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Diarrhoea, diuretic use</td>
<td>Decrease serum potassium</td>
</tr>
<tr>
<td></td>
<td>• Diminished renal function</td>
<td>Increase serum potassium, magnesium and phosphate</td>
</tr>
<tr>
<td>Complications</td>
<td>Cause</td>
<td>Symptoms</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>---------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Chronic dehydration</td>
<td>Decrease serum potassium and magnesium, the latter may induce refractory hypocalcaemia</td>
<td></td>
</tr>
<tr>
<td>Malabsorption, high intestinal losses</td>
<td>Zinc and fat-soluble vitamin deficiencies malabsorption</td>
<td></td>
</tr>
<tr>
<td>Hyperglycaemia</td>
<td>Excessive glucose</td>
<td>Increase nocturnal urine output, glucosuria during HPN infusion</td>
</tr>
<tr>
<td>Hypertriglyceridemia</td>
<td>Excessive fat</td>
<td>High triglyceride (if triglyceride $&gt;3.5$ mmol/L, consider to reduce the lipid dose)</td>
</tr>
<tr>
<td>Small Intestinal Bacterial Overgrowth (SIBO)</td>
<td>Increased bacterial concentration within the small intestine</td>
<td>Excessive flatulence, diarrhoea, abdominal bloating</td>
</tr>
<tr>
<td>Metabolic Bone Disease</td>
<td>Osteoporosis, osteopenia, osteomalacia</td>
<td>Bone pain, fractures</td>
</tr>
</tbody>
</table>
Table 6 Long-term HPN administration complications.

<table>
<thead>
<tr>
<th>Complications</th>
<th>Cause</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN associated Liver Disease (PNALD)</td>
<td>Multifactorial; duration of HPN, length of residual bowel, extent of enterohepatic circulation, lack of enteral feeding, infections, protein load, presence of undernutrition, choline deficiency, excessive glucose administration and excessive lipid emulsion, alcohol intake, viral hepatic disease.</td>
<td>Altered total and conjugated bilirubin, alkaline phosphatase.</td>
</tr>
<tr>
<td><em>Hepatomegaly, Ascites, Encephalopathy</em></td>
<td>Biliary stone formation</td>
<td>Altered aspartate aminotransferase (AST), alanine aminotransferase (ALT).</td>
</tr>
<tr>
<td>Metabolic bone disease</td>
<td>Osteoporosis, osteopenia, osteomalacia</td>
<td>Bone pain, fractures.</td>
</tr>
</tbody>
</table>

*Adapted from Siepler (2007)"
<table>
<thead>
<tr>
<th>Monitoring Parameters</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Weight</td>
<td></td>
</tr>
<tr>
<td>2. Temperature(°C)</td>
<td></td>
</tr>
<tr>
<td>3. Time Start</td>
<td></td>
</tr>
<tr>
<td>4. Time Stop</td>
<td></td>
</tr>
<tr>
<td>5. Infusion Rate</td>
<td></td>
</tr>
<tr>
<td>6. Blood Sugar Level</td>
<td></td>
</tr>
<tr>
<td>7. Blood Pressure</td>
<td></td>
</tr>
<tr>
<td>8. Aspiration(ml)</td>
<td></td>
</tr>
<tr>
<td>9. Output (ml)</td>
<td></td>
</tr>
<tr>
<td>10. Catheter care</td>
<td></td>
</tr>
<tr>
<td>11. Redness seen on catheter (Yes/No)</td>
<td></td>
</tr>
<tr>
<td>12. My General Health Today (on a scale 1-10, with 10 being the best)</td>
<td></td>
</tr>
</tbody>
</table>