1.0 PURPOSE

1.1 To describe the process for reviewing and processing TPN orders, to provide intravenous nutritional preparations to malnourished patients, for adequate time with maximum therapeutic benefit, minimum adverse effects, and without any drug wastage.

2.0 DEFINITION

TPN: Is a nutritionally hypertonic compounded solution which provides glucose, amino acids, lipid emulsion, vitamins and trace minerals via a central / peripheral venous access. It is commonly ordered for patients in situations when oral / enteral feedings cannot meet the patient’s nutritional needs due to malfunction of the GI tract. The goal of TPN Therapy is to replenish depleted stores of protein, promote wound healing, weight maintenance, immuno-competence, and nitrogen balance.

3.0 RESPONSIBILITY

3.1 TPN pharmacist: Is responsible for

3.1.1 Indicating the total protein and kilocalories required by the patient.

3.1.2 Explaining to the nurse the quantities of the solutions and how they will be administered.

3.1.3 Clarifying TPN orders directly with the physician.

3.1.4 Checking the volume and compatibility prior to entering the order into POE system and preparing it.

3.1.5 Verifying that all TPN orders are received.

3.1.6 Remarking the bag if a compounding error was made.

3.2 TPN administering nurse: Is responsible for determining the patient specifics, indicating it on the requisition form and sending the form to the pharmacy.
3.3 **Most Responsible Physician:** Is responsible for

3.3.1 Entering all TPN orders into the computerized Prescriber Order Entry system.

3.3.2 Notifying the TPN pharmacist if a compounding error was made.

3.4 **The inpatient pharmacy:** Is responsible for ensuring that the TPN unit has a daily list of patients receiving TPN.

4.0 CROSS REFERENCES POLICY

4.1 Handbook on Injectable Drugs.

5.0 POLICY

5.1 The TPN section of the pharmacy department has an effective and consistent policy for TPN according to the rules and regulations of the MOH and the CBAHI Standards.

5.2 Provision of specialized formulas of parenteral nutrition to patients with unique medical conditions that require a specified calculated amount of calories, proteins, and other medicinal based on specific criteria, will be compounded only in the pharmacy department under strict aseptic techniques and by a well-trained and certified TPN pharmacy staff.

5.3 The TPN unit implements a double check policy at each stage of compounding and visual inspection of the final parenteral nutrition product.

6.0 PROCEDURE

6.1 **Room and Equipment:**

6.1.1 The TPN Room is a separate, sterilized, and well ventilated room.

6.1.2 It is equipped with two safety cabinets for the preparation of sterile parenteral solutions, an apparatus for mixing solutions, a refrigerator, a desk, I.V. solutions, and other disposable items needed for work.

6.1.3 A reference book on stability / compatibility is available, (Handbook on injectable drugs).
6.2 Preparation of Solutions:

6.2.1 The pharmacy department has a special form for requesting TPN solutions to be used by the ordering physician.

6.2.2 Depending on the condition of the patient, the patient specifics are determined and indicated on the requisition form and sent to the pharmacy by the TPN administering nurse.

6.2.3 Once the request is received, the TPN pharmacist will make the proper calculations indicating the total protein and kilocalories required as well as other solutes that are needed, (i.e. vitamins & minerals based on the laboratory results and other criteria).

6.2.4 The TPN pharmacist will explain to the nurse what has been decided for the patient, the quantities of the solutions and how they will be administered.

6.2.5 TPN solutions are prepared for 24 hrs, from Saturday-thursday.

7.0 The prepared solution’s label should contain the following:

- 7.1.1.1 The patient’s name
- 7.1.1.2 Record and bed number (I.D)
- 7.1.1.3 Name of the drug
- 7.1.1.4 Strength
- 7.1.1.5 Instructions for use.
- 7.1.1.6 Expiration date

6.1.1 The prepared solution is good for 24 hours (stability) and it is to be kept in the refrigerator until the time of use.

6.1.2 TPN solutions should not be mixed with other intravenous solutions (separate lines should be used), unless it is discussed with the pharmacist to determine compatibility.

6.2 Time Limits for Accepting and Clarifying TPN Orders:

6.2.1 All orders must be in the pharmacy pickup bin, submitted electronically, or hand carried to the pharmacy by 2:00 pm. Orders are written to infuse from 5:00 pm through 4:59 pm the next day (with the exception of cyclical orders).

6.2.2 A new order for a patient who is currently on TPN will be accepted until 2:00 pm. Once an order is received in the pharmacy, the physician has until 3:00 pm to make any changes to the order. After 3:00 pm, the physician may either have the bag as ordered or order D10W.
6.2.3 An order change initiated by a physician before 3:00 pm should be considered a new order, put in writing and made available for pharmacy review and processing.

6.2.4 Notify the PRESCRIBER and the patient’s NURSE of all orders not received or accepted and why they were not accepted. Review the following procedure with him if necessary; Recommend hanging D10W in place of central TPN or IV fluid of choice for peripheral TPN until the following day’s orders are processed. If he does not understand or agree with this procedure, refer him to the policy.

6.3 Order Clarification:

6.3.1 Only complete order sheets will be processed. The following guidelines should be used when clarifying orders:

6.3.1.1 All components on the order sheet should be clearly written, i.e. patient name, history, number, nursing unit, base and electrolytes (within ranges) and no significant changes from previous day’s orders.

6.3.1.2 The order may not be written more than 24 hours before the time the bag is due to start.

6.3.1.3 All TPN orders will be entered by the physician using the computerized Prescriber Order Entry system (POE). Paper orders are not acceptable for these nursing units, unless in a downtime situation. If that happens, once that system is back up, the TPN orders must be entered into POE.

6.3.1.4 Clarified orders must be CLEARLY written before they can be processed. Orders may be verbally clarified but it is imperative that all changes are written consistently on the original white copy and the pharmacy copy. Make sure it is clear who will write the clarification on the original copy to avoid conflicts when the bag is hung. Any clarification made on the original by a nurse or a pharmacist must be as a verbal order and cosigned by the physician as per hospital policy. It is wise for the pharmacist to check the chart to ensure the original copy was changed.

6.3.1.5 Make sure all communications with nurses and physicians are clearly documented on the pharmacy sheet. This should include the clarifying pharmacist’s name, time of conversation and name of person with whom the order was clarified. This documentation will help resolve problems should they occur in the future.

6.4 Responsibility for order clarification:

6.4.1 It is the responsibility of the pharmacist to clarify TPN orders directly with the physician. The pharmacist should attempt to clarify standard order problems
Unusual changes in therapy may be clarified by the pharmacist.

6.4.2 The pharmacist will clarify all aspects of unclear orders with the physician.

6.5 **Responsibility for compounding TPN bags:**

6.6.1 The pharmacy TPN unit compounds TPN solutions. Orders should be sent to the TPN unit after entry into POE system. All original orders are due in the TPN unit by 3:00 pm. Exceptions will be made for orders for new patients, orders requiring clarification and changed orders, which will be accepted until 3:30 pm.

6.6.2 The inpatient pharmacy is responsible for ensuring that the TPN unit has a daily list of patients receiving TPN. The TPN pharmacist is responsible for verifying that all orders are received. If the TPN pharmacist does not receive an order, he/she is to follow-up with the appropriate satellite area.

6.6.3 If a compounding error is made, the physician is to notify the TPN pharmacist by 3:30 pm and the TPN pharmacist is responsible for remaking the bag.

6.6.4 When the lipid component of the TPN solution begins to separate from the rest of the solution, it will have the appearance of setting out with large visible fat particles on the surface of the TPN. As this process continues, the solution will become cracked and will show a distinctive separation of lipid from the other components of the solution. A cracked solution may also develop a light yellow “gummy” layer on the surface. If a cracked TPN solution is discovered, the nurse should notify the pharmacy immediately and not hang the solution. If the solution is already hanging on a patient, it should be discontinued. If the TPN was running through a central line, D10W should be hung in its place, and if the TPN was being administered peripherally, an IV fluid of choice should be used.

6.6.5 If a bag is spiked improperly by the nurse resulting in leakage, D10W should be hung in place of the TPN if a central line is being used and an IV fluid of choice if a peripheral line is used.

6.7 **Miscellaneous Procedures:**

6.7.1 New Starts

6.7.1.1 Saturday through Wednesday, the nurse will notify the pharmacy TPN unit of new central TPN starts.

6.7.1.2 Fridays and Holidays, Peripheral starts may be done without notification to TPN pharmacist. If an order is received on Friday for a new central start and the pharmacy was not notified, the order will not be processed. The pharmacy will contact the physician and offer Peripheral Parenteral Nutrition (PPN) as an alternative until the TPN pharmacist can evaluate the patient on Saturday. If the physician is insistent, he may contact the TPN pharmacist to discuss the issue.

6.7.2 TPN Administration; PPN may infuse through a central line or peripheral line. However, a central TPN must be administered through a “TPN designated” central line. No other medication or solution may be administered through a central TPN line.
6.7.3 Fat Emulsion: The standard volumes of 20% fat that may be added to parenteral nutrition solutions are 125, 250, or 500 ml.

6.8 **TPN Therapeutic Considerations:**

6.8.1 The following are examples of changes that must have the physician approval. The physician will notify the pharmacy TPN unit of these via the POE system &/or telephone.

6.8.1.1 Base changes: Any change in base from one day to the next, e.g. Peripheral to Standard.

6.8.1.2 Volume changes: Any change in base volume and/or lipid volume from one day to the next.

6.8.1.3 Insulin changes > 2 units: Changes must be increments of 5 units.

6.8.1.4 Start volumes:

6.8.1.4.1 Central line: 1000 ml base solution plus lipid volume, if needed. The high concentration of dextrose in a base (17-35%) infused too rapidly in a patient previously not on TPN poses the potential for significant hyperglycemia.

6.8.1.4.2 Peripheral line: 1500 ml base volume plus 125 ml lipid. If volumes less than these are ordered, or a PPN is ordered to be administered through a peripheral vein without lipids, the pharmacy will contact the physician and inform him/her of the minimum acceptable PPN volumes. If the physician is resistant to changing volumes, contact TPN pharmacist.

6.8.2 The following are guidelines for physician clarifications. The physician should be called for verification:

6.8.2.1 Exceeding electrolyte limits listed on the preprinted order form: TPN is for the maintenance of electrolytes, not for the adjustment of electrolytes. For electrolytes that are ordered over the limit, use the following guidelines:

- **Sodium** – While concentrations up to 190 mEq/L are physically compatible, 154 mEq/L is equivalent to normal saline, and rarely would more than this amount be required clinically.

- **Potassium** – Maximum concentration is 130 mEq/L

- **Phosphate** – Maximum concentration is 15 Mm/L. Higher concentration may result in calcium/phosphate precipitation. (If NO calcium is added, the maximum concentration is 25 Mm/L)

- **Calcium** – Maximum concentration is 9 mEq/L. Higher concentrations may result in calcium/phosphate precipitation.

  (If NO phosphate is added, the maximum concentration is 15 Mm/L)

- **Magnesium** – Maximum concentration is 16 mEq/L
Insulin – May add up to 100 units/L. Add in 5 unit increments, with a minimum of 10 units due to loss in tubing and bag (up to 50%). Insulin may be increased slowly. Guidelines are to add ½ to 2/3 of the previous day’s subcutaneous dose, rounded to the nearest 5 unit increment, to the TPN solution. A blood glucose level of 150 to 180 mg/dL is the goal for ideal glucose control. Patients with high insulin requirements (>70 units/L) may be candidates for an insulin drip.

6.4.2.1 Additions other than dose listed on TPN order form:

The only additives that are allowed are:

<table>
<thead>
<tr>
<th>Additive</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc</td>
<td>5 or 10 mg/day</td>
</tr>
<tr>
<td>Selenium</td>
<td>100 mcg/day</td>
</tr>
<tr>
<td>H2 blocker</td>
<td>Ranitidine 150 mg/day, maximum 300 mg/day</td>
</tr>
<tr>
<td>Thiamine</td>
<td>100 mg/day</td>
</tr>
<tr>
<td>Copper</td>
<td>0.5 mg/day</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>250 mg, maximum 2 g/day</td>
</tr>
<tr>
<td>Folic acid</td>
<td>1 mg, maximum 5 mg/day</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>maximum 40 mg/day</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>15 mg/day</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>1 mg/day, 5 mg one/week, or 10 g/day x 3 days</td>
</tr>
</tbody>
</table>

An electrolytes change from the previous day might be caused by spacing problems. When reviewing the profile, check for changes in electrolytes from the previous day. Verify with the physician if the change appears to be an error. Example: If a patient is on potassium acetate 40 mEq today an order is written for potassium acetate 40 mEq today and an order is written for potassium chloride 40 mEq for the next day, the doctor may indeed want potassium chloride, however, he may have written in the wrong electrolyte space on the order form.

6.8.3.4 Insulin orders in TPN are assumed to be human unless otherwise specified in the order.

6.8.2.5 Insulin changes:
Changes must be made in five unit increments. A change of 20 units or greater requires physician approval.

6.8.3 Large electrolyte changes:

To minimize wastage, the physician should not use TPN bags as the major means of correcting electrolyte imbalances. If there is a large increase in electrolyte requirements, the electrolyte content of parenteral fluids other than TPN should be adjusted. The TPN bags may not be remade or changed.

6.8.3 Restart TPN:

TPN: As a guideline, if a patient has been off TPN for more than 24 hours,

   D10W should be hung until the physician is contacted.
   PPN: May be restarted just as a new start PPN.

6.8.5 Special Formulations:

The TPN pharmacist is responsible for checking the volume and compatibility prior to entering the order into POE system and preparing

6.8.6 If a prescriber does not want any specific ingredient in the combination multiple vitamins or trace elements, he must write to not add the product, and then write to add each individual ingredient that he wants.

7.0 FORMS

7.1 Total Parenteral Nutrition Form.

7.2 Computerized Prescriber Order Entry system (POE).

8.0 EQUIPMENT

   8.1 2 Safety Cabinets, Refrigerator, Computer, Printer.

9.0 REFERENCES

   9.1 CBAHI resource manual.