Intravenous Nutrition (IVN)

Introduction

Intravenous Nutrition (IVN), previously known as parenteral nutrition, is comprised of amino acid / glucose (AA/glucose) and lipid components. IVN is managed in conjunction with the Paediatric Gastroenterology service. Any child who is being assessed for IVN should be discussed with the Paediatric Gastroenterology service. The team consists of: Paediatric Gastroenterologists, Paediatric Dietitians, Paediatric Pharmacist and Paediatric Gastroenterology Nurse Specialists. Queries related to IVN should be directed to the Paediatric Gastroenterology Fellow on week days or the Paediatric Gastroenterologist on-call on weekends.

This guideline is intended to assist in the appropriate assessment for and management of acute short term IVN administration in hospital and long term administration of IVN within the hospital and home context. This guideline should be used in conjunction with the nursing Central venous catheter management and Aseptic Non-Touch Technique (ANTT) Recommended Best Practice (RBP) documents.

It is the responsibility of all nursing staff caring for a patient with IVN to ensure that they have been assessed as competent to do so.

If there is any patient issue related to IVN that this guideline does not cover, please discuss with the Paediatric Gastroenterology service.

Indication

Infants and children may require IVN when adequate nutrition cannot be achieved enterally. IVN may be used to prevent or correct malnutrition or to sustain appropriate growth. It may be used for (but is not limited to) the following situations:

Acute:

- Patients who have not or will not achieve 50% of their nutritional requirements enterally/orally within the following time periods:
    - Infants 48 hours
    - Children 72 hours
    - Adolescent 5 days
- Patients in whom the use of the gastrointestinal tract is not anticipated for > 48 hours after abdominal surgery
- Pre or post cardiac surgery, where poor gut perfusion prevents enteral feeding
- Specific conditions affecting the gastrointestinal (GI) tract:
    - Mechanical obstruction
    - Extensive small bowel mucosal disease
    - Short bowel (resections of the small or large intestine before compensatory adaptation occurs)

Long-term:

- Intestinal failure where the gastrointestinal tract is unable to ingest, digest and absorb adequate macronutrients and/or water and electrolytes to maintain hydration and growth.
    - Short bowel syndrome, including functional short bowel
    - Intestinal dysmotility
    - Mechanical obstruction
    - Extensive small bowel mucosal disease (enteropathies causing protracted diarrhea)
    - Intestinal fistula

Where possible, IVN is managed in conjunction with trophic enteral nutrition and feeding should advance where achievable. Enteral nutrition is important to maintain baseline gut function, prevent intestinal failure associated liver disease and stimulate gut adaption and growth.

Intravenous access

Patients require CENTRAL venous catheter (CVC) access to receive full IVN. The child's clinical requirements should be considered and discussed with the Paediatric Gastroenterology service prior to the selection of CVC.

A surgically placed single lumen CVC is the preferred form of access for IVN delivery. Single lumen PICC lines are also used.

When a multi-lumen CVC is used, where possible, one lumen should be dedicated to the administration of IVN. This requires both physical identification (labeling) and documentation within the clinical record.

In the absence of a CVC, IVN may also be administered via a PERIPHERAL catheter. Peripheral IVN can be considered as a short term treatment option, for up maximum of 2 weeks, however the glucose component of the IVN must be less than or equal to 10%. The ideal osmolality of IVN for peripheral administration is < 850 mOsm/kg.

In some circumstances, IVN with a glucose concentration up to a maximum of 12.5% and an osmolality of < 850 mOsm/kg can be administered peripherally, however this will require review from the Paediatric Gastroenterology service.

Initiation of IVN

To initiate IVN for a new patient complete the 'Request for Paediatric Intravenous Nutrition' form and contact the Paediatric Gastroenterology Fellow. This form must be completed and scanned to pharmacy with the patients IVN prescription prior to pharmacy ordering the initial IVN supply.

At the weekend, verbal approval should be obtained from the Paediatric Gastroenterologist on call. The oncall pharmacist is also to be advised of the initiation of IVN.

The form location:
L:\Groups\STARSHIP\Intravenous Nutrition\Forms\Starship IVN prescription 2014.xls

Paediatric Day 1 Star IVN Bags

Standardised Paediatric Day 1 Star bags are available to use for paediatric patients that need to be initiated on IVN. These bags can be used for new patients only, until an individualised IVN order and supply can be arranged. Three bags for different weight categories are available; Star Red, Star Blue and Star Yellow. Each bag contains adequate nutritional components (protein, glucose, baseline electrolytes) for intravenous nutrition for an initial 24 to 48 hour period. They do not provide sufficient calories for full nutritional requirements. Starter bags are suitable for peripheral or central administration. Bags contain routine electrolytes at the low end of normal requirements and may not be suitable for all patients.

- Star **Red** 2.5 - 10kg
- Star Blue 10 - 25kg
- Star Yellow > 25kg (max 60kg)

Lipid will be available as a separate bag for infusion that can be run concurrently with the Paediatric Day 1 Star IVN bag. Lipids are dispensed in 100ml bags. Vitamins and trace elements are not included in the Day 1 Star bags or lipid. Refer to Appendix 1 for prescribing, ordering and administration guidance for Paediatric IVN Star Day 1 bags.

For patients greater than 60kg, consult the Paediatric Gastroenterology team.

Prescription and supply of individual IVN

IVN is prescribed by the patient's primary medical team in conjunction with the Paediatric Gastroenterology team. Please ensure that the ward pharmacist is notified of any patient initiating IVN. Refer to appendix 2 for prescribing guidelines for paediatric IVN.

Ordering time

All individualised prescriptions must be completed and scanned to Pharmacy by 11.30am to enable same day delivery of IVN. If changes to the IVN prescription are anticipated, the timing of blood tests needs to be such that results are available to ensure that the prescribing deadline is met. IVN can be prescribed daily from Monday to Friday. For stable patients IVN should be prescribed for 2 or 3 days in advance where possible.

Any IVN prescriptions received by Pharmacy after this time will not be ordered. If IVN cannot be ordered because blood tests have not been done, then the patient should receive the same

prescription as the previous day. New patients requiring IVN after the cut off time will receive IVN via the Paediatric Day 1 Star IVN Bag system. Refer to appendix 3 for the process involved.

Weekend / Public Statutory Holidays / out of hours supply

New Patients
To initiate IVN for a patient on the weekend, contact the on-call Paediatric Gastroenterologist to discuss. Prescriptions must be scanned to pharmacy and discussed with the on-call pharmacist verbally to confirm supply.

Existing Patients
IVN for Saturday and Sunday is prescribed on Friday. In exceptional circumstances, IVN for Saturday and Sunday may be prescribed and ordered on Saturday morning for delivery of Saturday and Sunday bags on Saturday. Prescriptions must be received in Pharmacy by 10:30am on Saturday morning. Contact the on-call Pharmacist via the operator to discuss. IVN will be delivered to pharmacy and checked by the on-call Pharmacist prior to delivery to ward.

IVN required outside of these times will only be made as an on-call service and on-call fees will apply.

Prescription

New Patients
The prescription is completed using the Starship IVN prescription which contains the 'Request for Paediatric Intravenous Nutrition' form, 'Paediatric Day 1 Star IVN Order Form' and 'Starship IVN Prescription Form'.

Completing the 'Request for Paediatric Intravenous Nutrition' automatically completes most patient details within the 'Paediatric Day 1 Star IVN Order Form' and 'Starship IVN Prescription Form' as these forms are linked. If a Paediatric Day 1 Star IVN bag has been prescribed at initiation of IVN, the content will be automatically filtered into the 'Starship IVN Prescription Form' to guide the prescriber as to what the patient was prescribed. The IVN prescriber will then alter the yellow boxes of this form to create new IVN prescription for the patient.

When the Starship IVN Prescription form is completed, printed, signed by a medical officer and dietitian it can then be scanned to pharmacy. The signed copy is then placed with fluid balance chart in the patient's clinical file. The rate of IVN is prescribed on the patient's fluid balance chart by the primary medical team during normal business hours. Refer to appendix 4 for examples of charting IVN bags.

Existing Patients
To order further IVN for patient's currently having IVN, locate the IVN prescription on the Starship L drive (L\groups\starship\Intravenous Nutrition\Ward number\Patient name). Complete the changes required and save the IVN prescription in the same location. Follow the same ordering process as described for new patients above.

Supply and delivery

The IVN prescription is checked and ordered by pharmacy staff, manufactured off site and delivered to pharmacy daily Monday to Friday. It will be checked by a Pharmacist with the aim that IVN will be delivered to the ward by 5:30pm allowing changeover to occur at 6pm.

Storage

If the IVN is not expected to be hung within 60 minutes of arrival on the ward, it is stored in the ward IVN refrigerator (between 2°C and 8°C). Bags stored in a refrigerator are to be kept well away from any freezer compartment to prevent ice crystal formation in the IVN. IVN is to be

removed from the refrigerator 60 minutes prior to hang time to enable the solution to reach room temperature.

Administration

It is important to co-ordinate all catheter cares inclusive of blood sampling and administration of medications to minimize the risk of contamination. The CVC and administration sets are managed as per the CVC and ANTT RBPs.

Do not add any other drug or solution to the prepared IVN bag once it has been issued by pharmacy, or the IVN provider.

Any infusions intended to run alongside the IVN should be **discussed with the ward/oncall Pharmacist** prior to commencement to ensure compatibility.

Individualized IVN: The administration set is pre-attached to the IVN, ensure all connections are secure. The IVN administration set includes an inline 0.2 micron endotoxin-retaining filter to prevent the administration of particulate contamination. Ensure the filter is located on the AA / glucose line **above** the point where the lipid and AA / glucose mix. Individual cases require daily change.
For newly initiated patients receiving Star bags, administration advice is included on the prescription this includes where to locate administration sets.

If the filter blocks during the administration of the IVN solution

- Stop the infusion and administer appropriate IV fluids if required
- Inform the medical team
- Inform the clinical pharmacist, or if out of hours the on-call pharmacist
- Return the administration set to pharmacy, to enable a root cause investigation.

If a patient is prescribed multiple infusions including intermittent antibiotics, ensure that a Y connecter is added to the circuit at setup. This will allow the IVN to be safely paused and recommenced (without disconnecting) when administering the prescribed antibiotic therapy.

Prior to priming the IVN, the label on the IVN bag is **independently double checked** against the prescription sheet by two nurses: right patient, right contents, right date, right volume, no visible contaminants. Both RNs are required to sign prescription chart and IVN bags.

The administration sets are primed and connected to the patient using an aseptic non touch technique. Chlorhexidine 2% and alcohol 70% wipes are used for cleansing prior to accessing /connecting lines as per CVC RBP. The smart site (or smart site plus if PICC line) is to be changed every 96 hours when connecting a new bag of IVN. Under some circumstances the patient may require daily smart site changes this should be discussed with the CNS. This should be considered in infancy if the CVC is located in close proximity to nappy, if the child has multiple stoma's or persistent diarrhoea where there is increased risk of contamination of the line. The CNS assessment & recommendation will be documented in the nursing care plan and clinical record.

Following connection and immediately prior to commencement, two nurses **independently double check** the intravenous pump programming (i.e. AA / glucose is at correct rate and lipid infusion is at correct rate) against the IVN prescription and fluid balance chart. The administration set should remain connected for the duration of that bag. If the IVN is disconnected from the patient, the bag and associated lines are discarded and the medical staff should be informed.

Bags are protected from light using an appropriate protective cover and taped closed at the bottom.

If the patient is unable to receive their prescribed IVN due to supply, contamination, accidental disconnection or other CVC related issues, the patient is to be started on an appropriate **standard replacement IV fluid** to prevent hypoglycaemia (e.g. 10% glucose). The usual IVN rate, fluid allowance and glucose concentration should be considered by the prescribing doctor. Additional electrolytes should not be added to standard fluid bags to mimic IVN concentration. Complicated patients should be discussed with the on-call Paediatric Gastroenterologist to ensure an appropriate alternative is charted.

If there is an accidental disconnection:

- Discard the IVN
- Do not re-spike the bag of IVN
- Discuss with the medical team and arrange for replacement fluids

Type of bag	Hang time from connection
Star bag (Red, Blue, Yellow)	48 hours
Individualised Amino Acid + Glucose	24 hours
P100	72 hours
Lipid (syringe or bag)	24 hours

Home IVN patients

For patients receiving IVN 6-7 days per week routine CVC maintenance for preventing catheter related bloodstream infections is 70% ethanol locks administered **three times per week** for a dwell time of **minimum 4 hours** but not longer than 24 hours. Check intraluminal volume from CVC manufacturer details and administer ethanol lock of equivalent volume.

NOTE: This is routinely aspirated and discarded, however evidence supports the safety of ethanol of this quantity being flushed into the bloodstream.

On alternate days, heparinised saline will be used to lock the CVC when not in use.

Cyclical IVN

Cyclical IVN is where the IVN requirement is administered over less than 24 hours per day. Cyclical IVN is preferred where possible to allow patients to have freedom from lines and equipment where possible, and to reduce the risk of hepatic complications associated with continuous IVN infusion. Cyclical IVN is well tolerated from 3 - 6 months of age.

Maximal glucose infusion rate	
3 months - 3 years (5 – 14 kg)	13 mg/kg per minute
3 – 18 years (14 – 70 kg)	20 mg/kg per minute

The AA / glucose rate is halved for the last hour of prescribed time to reduce rebound hypoglycaemia.

The Starship IVN prescription will calculate the hourly rate to run the IVN, however the following calculation may also be used:

$$\text{Hourly rate} = \frac{\text{Total volume AA glucose} \times 2}{[(\text{Hours} \times 2) - 1]} \qquad \text{Last hour} = \frac{\text{Hourly rate}}{2}$$

In the hours off IVN, check blood glucose hourly for the first 2 - 3 days with finger prick blood glucose in order to detect rebound hypoglycaemia. Infants, severely malnourished patients, those with liver disease and minimal hepatic glucose stores are at greatest risk of rebound hypoglycaemia.

Infants who are not receiving enteral feeds should not be cycled off IVN for longer than 3 - 4 hours. For older children consider glucose sweets, sips of fruit juice during time off IVN.
NOTE: Lipid infusions are administered over a maximum 20 hours for all patients except PICU patients, where AA / glucose and lipid administered over 24 hours.

Monitoring

Standard monitoring for inpatients includes:

- IVN Laboratory monitoring
- 4 hourly Temperature, Pulse and Respiration (TPR) & Blood Pressure, with a calculation and documentation of the patients PEWs score
- Accurate fluid balance record
- Check infusion pump pressure
- Anthropometry: Daily weight (same time, same scales), length and height should be measured monthly for long-term patients and head circumference should also be measured monthly for infants
- Nutrition intake: oral, enteral and parenteral

All lines and connections should be checked hourly for leakage and kinking

IVN Laboratory Monitoring

IVN patients can have blood sampled from a single lumen catheter using an aseptic, non-touch technique. Bloods required as per the schedule below are to be taken prior to commencing a new bag of IVN. The Dietitian records the patient's blood results daily and results are recorded on the Intravenous Nutrition Laboratory Summary sheet. Monthly results are recorded on the Intravenous Nutrition Monthly Bloods Summary sheet.

Laboratory Tests

Use the LabPlus Paediatric IVN Monitoring form to order blood tests. Refer to appendix 6.

Frequency	Specimens required	Tests required
Baseline	2 green heparin 1 lavender EDTA Blood gas syringe or capillary sample	Capillary blood gas, FBC Na, K, Cl, urea, creatinine, glucose, Ca, Mg, PO4, albumin, LFT, Lipid profile *Urine Na, K,& Cr (casual)*
Weekly or if IVN script changing ▪ Generally routine monitoring bloods are taken at IVN hook on or 4 hours after IVN has been disconnected. ▪ If the IVN script needs frequent changes, bloods should be taken at 6am as a finger prick.	2 green heparin 1 lavender EDTA	FBC, Na, K, Cl, urea, creatinine, glucose, Ca, Mg PO4, albumin, LFT, Lipid profile *Urine Na, K,& Cr (casual)*

To allow same day changes to the prescription please ensure the blood form includes an urgent sticker.		
Monthly **(at IVN bag hook up)**	3 green Heparin (1 Heparin tube wrapped and protected from light for vitamins A, D and E) 1 lavender EDTA	Capillary blood gas (or bicarbonate for home patients) FBC, Na, K, Cl, urea, creatinine, glucose, Ca, Mg PO4, albumin, LFT, Lipid profile Iron + Iron Binding Capacity (IBC), Ferritin, B12, Folate Cu, Mn, Se, Zn Vitamin A, Vitamin D, Vitamin E *Urinary Na, K,& Cr (casual)*
3 monthly - Annual	2 green Heparin 2 lavender EDTA 1 Citrate 1 SST	HbA1c, Coagulation screen, Thyroid function, Cystatin C, PTH, P1NP, blood pressure, urine protein: creatinine and calcium: creatinine ratios (in addition to monthly bloods)

Home IVN patients may also require annual DEXA scans from 5 years of age. Patients should have basic renal assessment annually which includes urinary tests and blood pressure. Any abnormal results will be discussed with the Starship paediatric renal team.

For accuracy purposes the CVC should be sampled immediately prior to IVN administration (at hook up) or 4 hours after stopping the lipid infusion.

Starship inpatient transfer to other hospitals

Children requiring ongoing IVN should not be transferred to other hospitals unless a management plan is in place. Extensive planning is required and the paediatric Gastroenterology team is to be involved to assess feasibility. The paediatric nutrition support pharmacist will require a minimum of 3 working days notice to transfer any patient to another hospital on IVN.

Patients on IVN for >20 days

Please contact the Paediatric National Intestinal Failure Service (NIFS) co-ordinator nznifs@adhb.govt.nz to obtain a registration form once your patient has been on IVN >20 consecutive days or >20 cumulative days during a single admission. For preterm infants in NICU born before 34 weeks of gestation, the registration should be made at >31 cumulative days of IVN.

Transition feeding

Transition to enteral feeding will be considered on an individual basis in consultation with the Paediatric Gastroenterology team. If enteral/oral feeding tolerance is uncertain, order a full prescription of IVN. Once enteral/oral intake is established, AA / glucose rate can be decreased as enteral/oral feeding is progressed by up to 30% per day. Lipid rate remains unchanged initially.

Stop vitamins, minerals and trace elements in IVN (Vitalipid, Soluvit and Startrace) and halve electrolytes when enteral/oral feeding provides 50% of energy requirements.

IVN should only be stopped once enteral/oral intake is at least 75% of energy requirements. Transition may take 3 - 7 days or longer e.g. short gut patients. Accurate input and output records are required.

Home IVN

Process

All patients that require long term IVN should be referred to and assessed by the Paediatric Gastroenterology team to determine if home IVN is appropriate. Determination of suitability will include a full psychosocial assessment and home environment suitability. All decisions to commence home IVN will be made by the Paediatric Gastroenterology team in collaboration with the child's primary clinical teams. Coordination of discharge planning needs to occur as early as possible as IVN providers will require as much forewarning as possible.

Biomed provides home IVN for patients within the Auckland region and ongoing prescription of IVN and monitoring is managed by the Paediatric Gastroenterology team during their weekly round.

If the child is from outside of Auckland then the IVN provider will vary depending on contractual obligations within the particular DHB. The Paediatric Gastroenterology team will determine whether the local paediatric clinical team will provide ongoing prescription of IVN and monitoring or if the paediatric Gastroenterology team will provide the ongoing IVN management.

The majority of regional hospitals have a contract with Baxter to provide home IVN for adult and paediatric patients which will differ from the Biomed product. The Paediatric Gastroenterology team will need to manage the transition to the Baxter product prior to transfer of the child.

Education

When beginning discharge planning it is essential to establish the requirements for parental education and respite through the completion of a needs assessment.

Where a shared care arrangement is in place, the patient's local paediatric clinical team will maintain ongoing responsibility for prescribing IVN. The Paediatric Gastroenterology team will negotiate with the local team re: training requirements for parents and caregivers, including consideration of location of training and the availability of appropriate staff to facilitate training. CNS and Multidisciplinary Team (MDT) will make recommendations as to the appropriate training regimen. Each shared care arrangement including training, sign off process and support by Starship staff will be determined by the individual child/family and available local resource. Starship IVN related resources will be shared with the shared care team.

For patients from the greater Auckland region the initial education and management of logistics will be overseen by the Paediatric Gastroenterology Clinical Nurse Specialists. Every effort should be made by all members of the nursing team to ensure consistency of IVN management (administration technique) to assist family members with their knowledge and skill development. An individualised teaching package will be used for each child, which will require sign off as family members demonstrate their new skills. Family members will be taught by the Starship nursing staff (ward staff nurses in partnership with the CNS Team). All documentation is to be kept in the planning section of the patient's clinical record. Normally the CNS team would expect to train both parents and one other carer for the provision of respite. Requests for additional training will require discussion with the CNS team.

The Clinical coordinator from the IVN provider is responsible for family education related to IVN administration via the ambulatory home pump, including priming administration sets and set up of home IVN deliveries upon discharge. Prior to commencing training with the clinical coordinator family members are expected to demonstrate competency in performing hand hygiene and to have

achieved competency in the provision of their child's CVC related cares as per the CVC RBP. The clinical coordinator also provides on-call support for clinical issues related to the patient's home pump in the inpatient and outpatient setting. The child will be transitioned to the home setup as soon as practical and prior to discharge.

Discharge & transfer of home IVN patients

It is not possible to discharge a home IVN patient from outside the Auckland region on Mondays due to the planning of supply and deliveries. IVN for patients outside of Auckland will usually be delivered via overnight courier.

New Patients
If a new home IVN patient requires Baxter IVN on discharge, this requires at least 3 working days notice for discharge home or to an outlying hospital.

Existing Patients
The IVN prescription should be received by Baxter by 10am Monday to Thursday and IVN can be delivered the next day to patient's home.

Setup of All-In-One IVN bags for Home IVN patients

Patients on home IVN receive their IVN in one bag that contains amino acids, glucose, electrolytes and lipid. They receive a infusion pump from the IVN provider that is different to Starship infusion pumps Unlike the Starship inpatient dual bag system, the bags require spiking using aseptic non touch technique.

When Caregiver training is to be initiated the Paediatric Gastroenterology team will endeavour to order IVN in Starship a day ahead of time to ensure supply is available for a 4pm setup time to ensure optimal training opportunities. The home IVN infusion pumps calculate infusion rates. There is a separate All-in-one IVN prescription for home IVN patients incorporating administration details. Caregiver training should only be commenced once the patient's prescription is suitably stable meaning that daily changes are no longer required.

Home IVN patient admission to wards

Established Home IVN patients admitted to the ward Monday to Friday and at weekends will continue to use their home IVN bags, lines and home IVN infusion pumps on the ward. Home IVN caregivers are responsible for ensuring they bring the available bags and pump to ensure there is no disruption in prescribed treatment. Should a caregiver arrive without their child's pump and lines the inpatient team can contact the Biomed product coordinator who will arrange to deliver a pump and lines to the ward.

Where patients are to be admitted electively the CNS is responsible for notifying the dietetic and pharmacy services of the admission. IVN will be ordered prior to admission to ensure availability on admission day. Home IVN patients admitted to the hospital should be prioritised to have a bed on Ward 26B.

When the patient is being considered for discharge, please ensure the Clinical Pharmacist is notified at the earliest opportunity to ensure delivery arrangements are updated with the IVN provider.

Troubleshooting

Contact the child's primary medical team in the first instance if there are any problems with IVN management. If IVN has not arrived on the ward by 5:30pm, Monday to Friday and on Saturday, contact the on-call Pharmacist via switchboard.

Where there are problems with any aspect of IVN management out of business hours that can not be addressed by the child's primary medical team, contact the on-call Paediatric Gastroenterologist and on-call Pharmacist. Refer to appendix 7 for answers to frequently asked questions.

Suspected catheter related blood stream infections (CRBSI) – refer to ADHB policy – Central Venous Catheters in Children

- Clinical review including full history and examination is required in the following circumstances
    - child is unwell
    - fever >38.5°C x 1 or 38.0°C on two occasions one hour apart
    - CVC exit site is tender, oozing or inflamed

- In these circumstances central and peripheral blood cultures are to be taken. The CVC exit site must be examined, including palpation of the tunnel. The CVC dressing requires removal and renewal in this instance.

- Be aware that exit site infection may occur in the absence of systemic features/symptoms. Any tenderness or discharge at the exit site needs to be reported by the family to the Paediatric Gastroenterology Clinical Nurse Specialist.

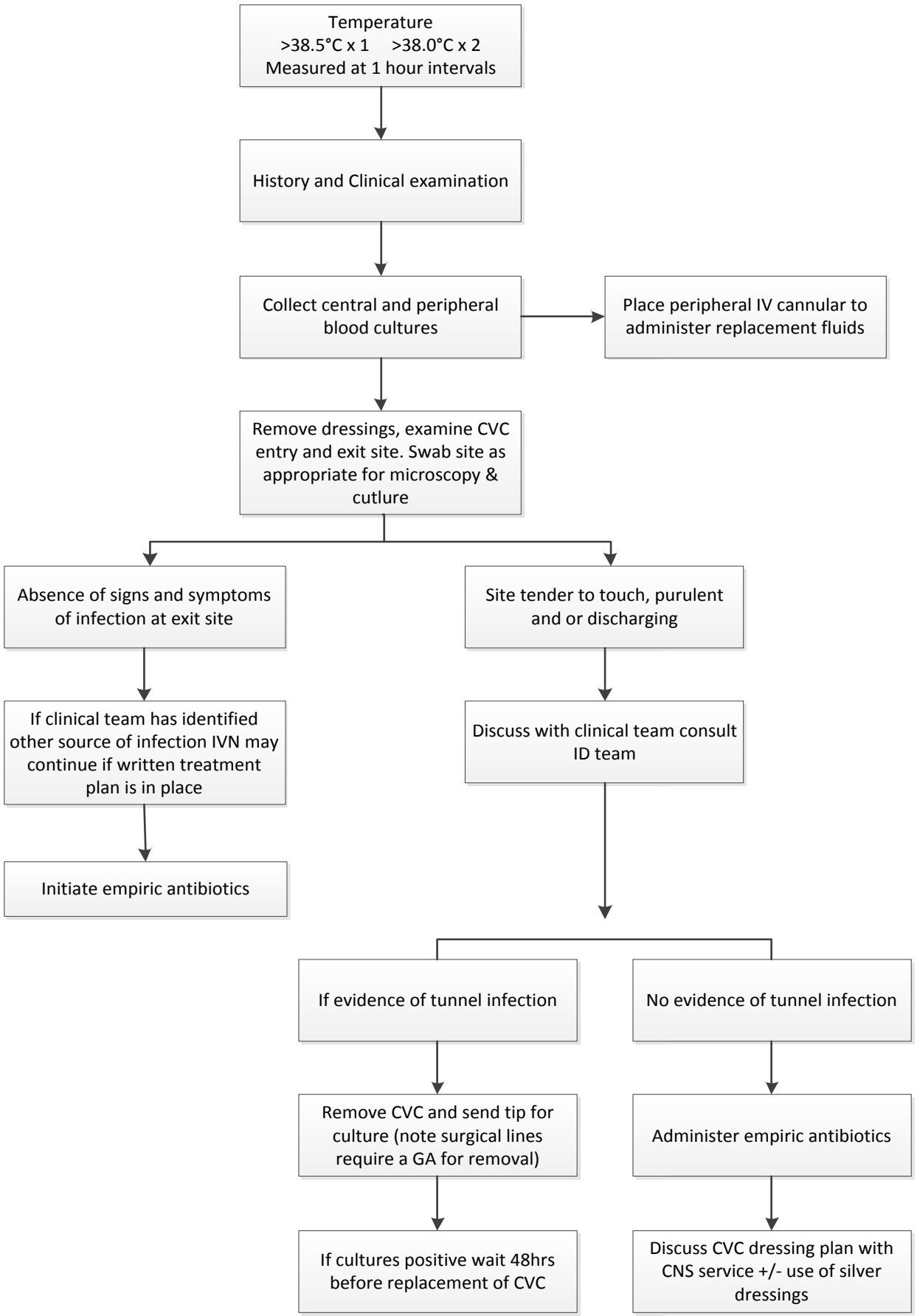
- After review, if no other site of infection is identified then empiric antibiotics covering for central line sepsis need to be initiated once appropriate cultures have been taken. In most circumstances antibiotics should be administered through the CVC. Flucloxacillin and gentamicin can be considered as empiric antibiotics however other factors may influence antibiotic selection such as ESBL status, previous positive cultures, immune status and renal function.

- Every effort should be made to preserve the patient's CVC, however there are some situations such as tunnel infection when a line will need to be removed.

- On-going management including the need for line removal will be based on clinical review and culture results.

- Lock therapy either antibiotic or 70% ethanol may be considered in some situations – this will need to be discussed with the Paediatric Gastroenterology and Infectious Diseases Team (see ADHB Policy: Central Catheters (CVC) in Children.pdf)

MANAGEMENT OF SUSPECTED CVC SEPSIS & PARENTERAL NUTRITION FLOW CHART



Appendix 1: Paediatric day 1 star IVN bags

Three bags for different weight categories are available: Star **Red/**Blue/Yellow bags

Day 1 Star IVN Bag Composition			
Nutritional Composition per 1000ml	**Star Red** **2.5 kg to 10 kg infants**	**Star Blue** **10 kg to 25 kg child**	**Star Yellow** **25 kg to 60 kg child**
Glucose	90 g/L	85 g/L	80 g/L
Protein	15 g/L	15 g/L	30 g/L
Sodium	25 mmol/L	15 mmol/L	35 mmol/L
Potassium	15 mmol/L	15 mmol/L	27 mmol/L
Phosphate	10 mmol/L	3 mmol/L	6 mmol/L
Magnesium	1.52 mmol/L	1.54 mmol/L	3 mmol/L
Calcium	7 mmol/L	3 mmol/L	5 mmol/L
Energy from Star bag only	**365 kcal/L**	**348 kcal/L**	**389 kcal/L**
Lipid (Clinoleic)	1 g/kg/d	1 g/kg/d	0.5 - 1 g/kg/d
Lipid energy	2000 kcal/L	2000 kcal/L	2000 kcal/L
Osmolality	666 mOsm/kg	626 mOsm/kg	797 mOsm/kg

Lipid will be available as a separate bag for infusion that will be run concurrently with the Day 1 Star bag.

Prescribing guidance

To prescribe a Paediatric Day 1 Star IVN Bag:

1. Select correct Day 1 Star IVN bag (**Red/**Blue/Yellow) for the weight of the child.
2. Select lipid prescription: 1g/kg/day or 0.5 g/kg/day for children > 40 kg
3. Select total number of Day 1 Star IVN and lipid bags required
4. Prescription is to be printed and signed by a medical officer
5. Place patient sticker on Day 1 Star IVN prescription and scan to pharmacy, along with the Request for Paediatric Intravenous Nutrition form
6. Contact the Paediatric/Oncall Pharmacist to organise supply
7. Day 1 Star **Red/**Blue/Yellow and lipid bags will also need to be prescribed on the patient's fluid chart by the primary medical team caring for the patient during business hours

The table in the middle of each Day 1 Star IVN prescription form is designed to show the prescriber the content of the Day 1 Star IVN bag per 1000ml and per kg per day.

Ordering guidance

- To order these bags, the existing process for initiating IVN should be followed
- Dietitians will notify pharmacy when there is a new patient
- A Paediatric Pharmacist will screen the prescription and Star **Red/**Blue/Yellow and lipid bags will be dispensed for the patient by pharmacy. Where possible IVN should be ordered and supplied to the ward within working hours (**before 4pm**)
- No stock of these bags is kept on the ward

Nursing administration

- Each patient will be dispensed a **Red/**Blue/Yellow bag and a lipid bag by pharmacy.
- Check the child's weight and check you have the correct bags dispensed as per the prescription.
- Follow the nursing administration instructions on the prescription.
- No lines will be attached to the bags when you receive them from pharmacy. Follow aseptic non-touch technique to spike the bags with the appropriate administration sets. Join the administration sets at the Y-site connector port below the inline filter.

Star **Red/**Blue/Yellow bags	Attach giving set **with in-line filter** CODE: Alaris 60033E
Lipid bags	Attach BLUE low sorbing giving set with **NO filter** CODE: Alaris 63260NY
	Attach the lipid administration set to the **Red/**Blue/Yellow bag administration set at the smart site below the in-line filter.

- Independently double check IVN bags against the prescription as per the process for regular IVN. Refer to the Interim Nursing Guideline for Intravenous Nutrition.
- Both nurses are required to sign the prescription.
- Independently double check the intravenous pump rates against the IVN prescription.
- IVN will run over 24 hours. Write start time on the label of each bag.
- For patients that receive the Paediatric Day 1 bag system for more than 24 hours:
    - Star **Red/**Blue/Yellow bags can be hung for up to **48 hours.**
    - Lipid bags must be changed every **24 hours**.

Appendix 2: Paediatric IVN prescribing guidelines

These guidelines are for term infants and children receiving individually prescribed IVN.

- Premature infants, < 37 weeks gestation, consult the Neonatal Dietitian
- Older children, > 60kg, consult the Starship Paediatric Gastroenterology team

FLUIDS	**ml/kg/day**
Term neonates	120 - 150 ml/kg
Infants 4 – 10 kg	100 - 120 ml/kg
Children 10 - 20 kg	80 - 120 ml/kg
Children 20 - 50 kg	1500 ml + 20 ml/kg over 20 kg
Adolescents > 50kg	30 – 40 ml/kg

- Fluid requirements may need adjusting for medical condition, enteral and oral intake
- Enteral feeds > 10ml/kg should be included as total fluid allowance
- Lipid emulsion volume contributes to total IVN volume
- Give IVN volumes > 2.5 L with caution

ENERGY	**kcal/kg/day**
Term neonates	90 - 100 and up to 120
Infants 4 - 10 kg	80 - 100
Children 10 - 20 kg	75 - 90
Children 20 - 50 kg	60 - 75
Adolescents > 50 kg	30 - 50

- Target low end of energy requirement range initially
- Adjustment may be required for factors such as fever, sepsis, surgery and physical activity level
- An alternative method of estimating energy requirements is to use Schofield (WH) + PAL
- Non-nitrogen calories : g Aim N = 150-250 :1

Carbohydrate (GLUCOSE)	**g/kg/day**			
	Day 1	Day 2	Day 3	Day 4
Term neonates	8	12	14	16 -18
Infants 4 - 10 kg	8	12	14	16 -18
Children 10 -15 kg	6	8	10	12 -14
Children 15 - 20 kg	5	7	9	10 -13
Children 20 - 30 kg	5	7	9	< 12
Children 30 - 50 kg	3	5	5	< 8
Adolescents > 50 kg	3	4	5	< 7

- **Peripheral line glucose concentration should not exceed 10% without Consultant approval**
- CHO should comprise 50-65% of total calories
- Give glucose concentration > 25% with caution
- Glucose = 3.4 kcal/g *(Biomed data)*

Maximal glucose infusion rate	
3 months to 3 years (5 – 14 kg)	13 mg/kg per minute
3 – 18 years (14 – 70 kg)	20 mg/kg per minute

PROTEIN	**g/kg/day**		
	Day 1	Day 2	Target
Term neonates	1.5	2.5	3 – 3.5
Infants 4 - 10 kg	1.5	2.5	3
Children 10 - 15 kg	1	2	2.5
Children 15 - 50 kg	1	2	2
Adolescents > 50 kg	0.8	1	0.8 – 2

- Requirement decreased in renal failure or liver failure
- Requirement increased in critical illness and severe malnutrition
- Nitrogen (g) = protein (g) ÷ 6.25
- Protein = 3.9 kcal/g
- Use AA solutions without electrolytes
- Starship AA solution is TrophAmine® 10%

AA Solutions	Weight range
TrophAmine® 10% *(B.Braun)*	Term - 50 kg
FreAmine® 10% *(B.Braun)*	> 10 kg
Primene® 10% (*Baxter*)	Term – 10 kg
Synthamin 17® 10% *(Baxter)*	> 10 kg

FAT	**g/kg/day**		
	Day 1	Day 2	Day 3
Term neonates	1	2	3 - 4
Infants 4 - 10 kg	1	2	3 - 4
Children 10 - 15 kg	1	2	2 - 3
Children 15 - 50 kg	1	2	2
Adolescents > 50 kg	0.5 – 1.5		

- Fat should comprise 25-40% total calories
- Cycle lipid over 20hrs once full volume is reached. **Note** In Paediatric ICU lipid may be run over 24hrs
- Fasting serum triglyceride level should remain routinely < 2.0 mmol/L, however up to 4.0 mmol/L may be tolerated
- A minimum of 0.1 g/kg of linoleic acid is required to prevent essential fatty acid deficiency

Lipid	Soybean	Olive	MCT	Fish	Vitamin E (mg / ml)	Linoleic acid (g / ml)	Kcal/ml
SMOF® 20%	60 g (30%)	50 g (25%)	60g (30%)	30g (15%)	0.16 – 0.23	0.03	2
ClinOleic® 20%	40g (20%)	160g (80%)	0	0	0.03	0.02	2
Omegaven® 10%	0	0	0	100g (100%)	0.15 – 0.3	0	1
ClinOleic® 20% + Omegaven® 10% 0.2g/kg	33g (17.5%)	132g (70%)	0	24 g (12.5%)	0.05 – 0.09	0.02	1.9

The Starship Paediatric Gastroenterology service does not recommend the use of soybean predominant lipid emulsions for infants and children

Electrolytes	**mmol/kg/day**				
	Sodium	Potassium	Phosphate	Magnesium	Calcium
Term neonates	2 - 5	1 - 3	0.5 - 1.5	0.1 - 0.5	0.8 - 1.5
Infants 4 - 10 kg	2 - 4	1 - 4	0.5 -1	0.1 - 0.5	0.5 - 1
Children 10 – 20 kg	1 - 3	1 - 3	0.2 - 0.5	0.1 - 0.3	0.2 - 0.5
Children 20 - 50 kg	1 - 3	1 - 3	0.2 - 0.5	0.1 - 0.3	0.2 - 0.5
Adolescents > 50 kg	1 - 2	1 - 2	0.2 - 0.5	0.05 - 0.3	0.2 - 0.5

- If serum electrolyte level is normal, start at lower end of range
- Electrolytes should only be altered if outside the normal range
- Additional electrolytes may be required due to losses from diarrhoea, stomas or fistulas
- Medications e.g. diuretics and Amphotericin B, can increase K requirements
- Monitor K, Mg and PO4 closely if there is a risk of Re-feeding Syndrome

Trace elements

Startrace (Biomed)	1ml/kg up to maximum 15ml/day

Per ml	Zinc	Selenium	Manganese	Copper	Fluoride	Iodide
Startrace	250 μg (0.25mg)	2 μg	1 μg	20 μg	57μg	1 μg

Zinc	Extra zinc may be added to IVN based on Zinc RDI < 3 months 0.25 mg/kg/day > 3 months 0.1 mg/kg/day Children 0.05 mg/kg/day (max 5 mg/day)

Vitamins

	Vitalipid® (Fat soluble vitamins)	**Soluvit® (Water soluble vitamins)**
Term neonate – 5 kg	2 ml/kg Maximum 10 ml/day	1 ml/kg Maximum 10 ml/day
> 5 kg	1 ml/kg Maximum 10 ml/day	0.5 ml/kg Maximum 10 ml/day

- Vitamins are usually added to the lipid emulsion
- If no lipid is prescribed no Vitalipid can be given
- Soluvit can be added to AA + glucose bag (the solution will be yellow)
- Higher doses may be used based on vitamin levels

Soluvit

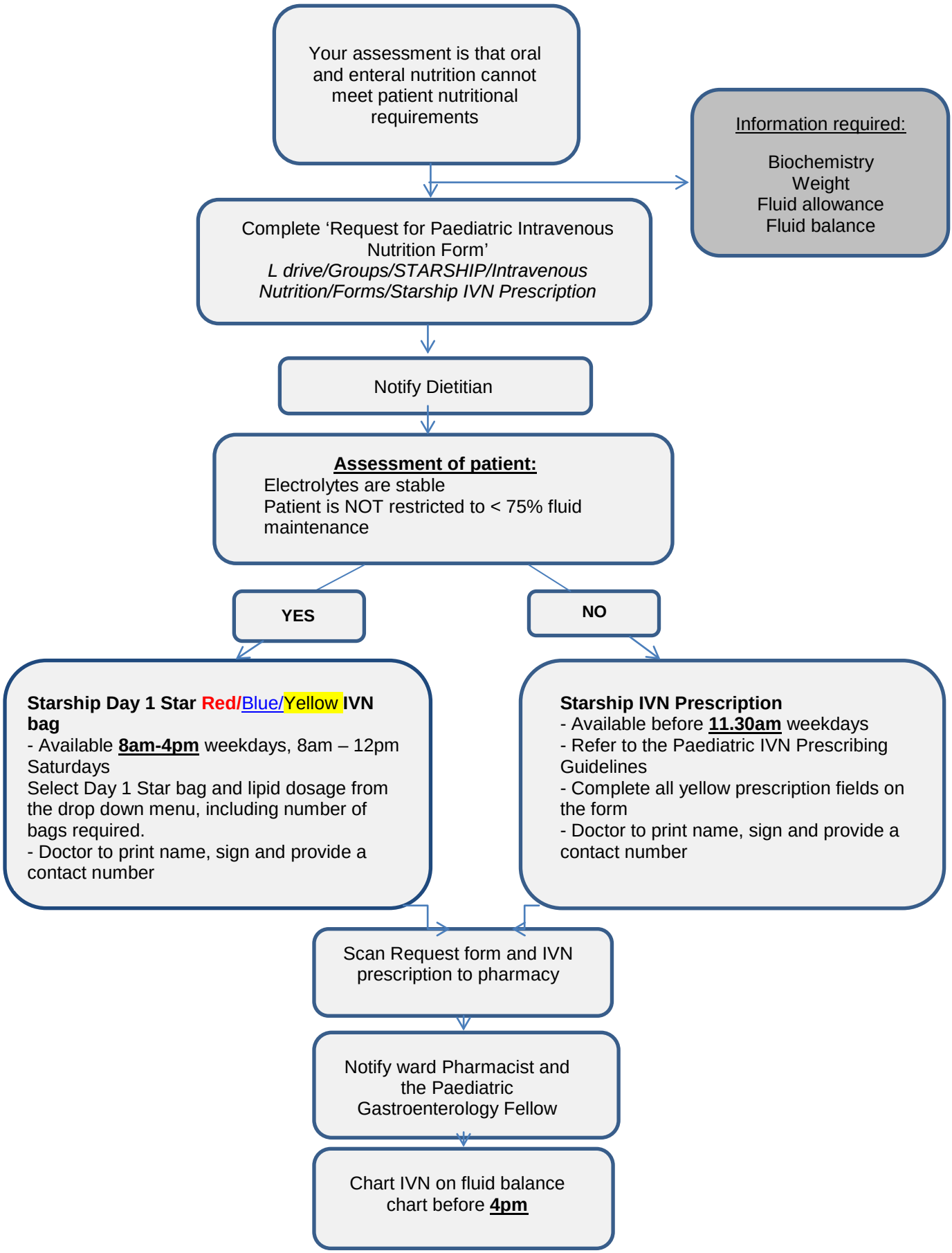
Per ml:
Biotin 60 mcg, cyanocobalamin 5 mcg, folic acid 400 mcg, glycine 300 mg, nicotinamide 40 mg, pyridoxine HCl 4.9 mg (equiv. vit B_6 4 mg), riboflavin Na phosphate 4.9 mg (equiv. vit B_2 3.6 mg), Na ascorbate 113 mg (equiv. vit C 100 mg), Na pantothenate 16.5 mg (equiv. pantothenic acid 15 mg), thiamine nitrate 3.1 mg; Na edetate, methyl hydroxybenzoate

Vitalipid is changed from Vitalipid N Infant to Vitalipid N Adult at 11 years

Per ml	Vitamin A	Vitamin D	Vitamin E	Vitamin K
Vitalipid N Infant	69 μg	1 μg	0.64 mg	20 μg
Vitalipid N Adult	99 μg	0.5 μg	0.91 mg	15 μg

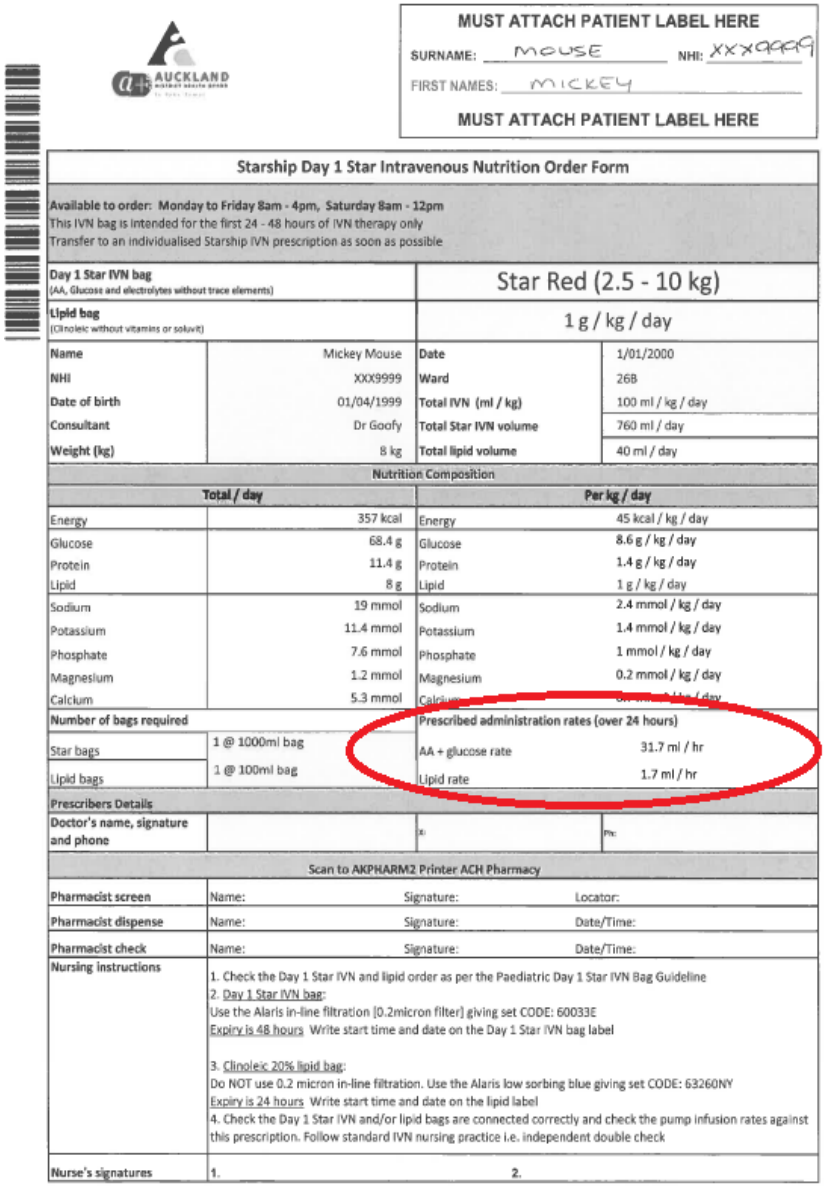
Iron is not added due to stabilization properties of IVN solution. If patient on IVN > 3 weeks or if Hb ≤85 mg/L, consider iron polymaltose infusion for children from term – 6 years of age and ferric carboxymaltose infusion for children > 6 years of age

Appendix 3: Process for initiating, ordering and prescribing IVN for a new patient



Appendix 4: Charting IVN

Example 1: Charting of Starship Day 1 Star IVN Prescription



MUST ATTACH PATIENT LABEL HERE
SURNAME: MOUSE NHI: XXX9999
FIRST NAMES: MICKEY
MUST ATTACH PATIENT LABEL HERE

Starship Day 1 Star Intravenous Nutrition Order Form

Available to order: Monday to Friday 8am - 4pm, Saturday 8am - 12pm
This IVN bag is intended for the first 24 - 48 hours of IVN therapy only
Transfer to an individualised Starship IVN prescription as soon as possible

Day 1 Star IVN bag (AA, Glucose and electrolytes without trace elements)	Star Red (2.5 - 10 kg)
Lipid bag (Clinoleic without vitamins or soluvit)	1 g / kg / day

Name	Mickey Mouse	Date	1/01/2000
NHI	XXX9999	Ward	26B
Date of birth	01/04/1999	Total IVN (ml / kg)	100 ml / kg / day
Consultant	Dr Goofy	Total Star IVN volume	760 ml / day
Weight (kg)	8 kg	Total lipid volume	40 ml / day

Nutrition Composition

Total / day		Per kg / day	
Energy	357 kcal	Energy	45 kcal / kg / day
Glucose	68.4 g	Glucose	8.6 g / kg / day
Protein	11.4 g	Protein	1.4 g / kg / day
Lipid	8 g	Lipid	1 g / kg / day
Sodium	19 mmol	Sodium	2.4 mmol / kg / day
Potassium	11.4 mmol	Potassium	1.4 mmol / kg / day
Phosphate	7.6 mmol	Phosphate	1 mmol / kg / day
Magnesium	1.2 mmol	Magnesium	0.2 mmol / kg / day
Calcium	5.3 mmol	Calcium	[illegible]

Number of bags required		Prescribed administration rates (over 24 hours)	
Star bags	1 @ 1000ml bag	AA + glucose rate	31.7 ml / hr
Lipid bags	1 @ 100ml bag	Lipid rate	1.7 ml / hr

Prescribers Details			
Doctor's name, signature and phone		x:	Px:

Scan to AKPHARM2 Printer ACH Pharmacy

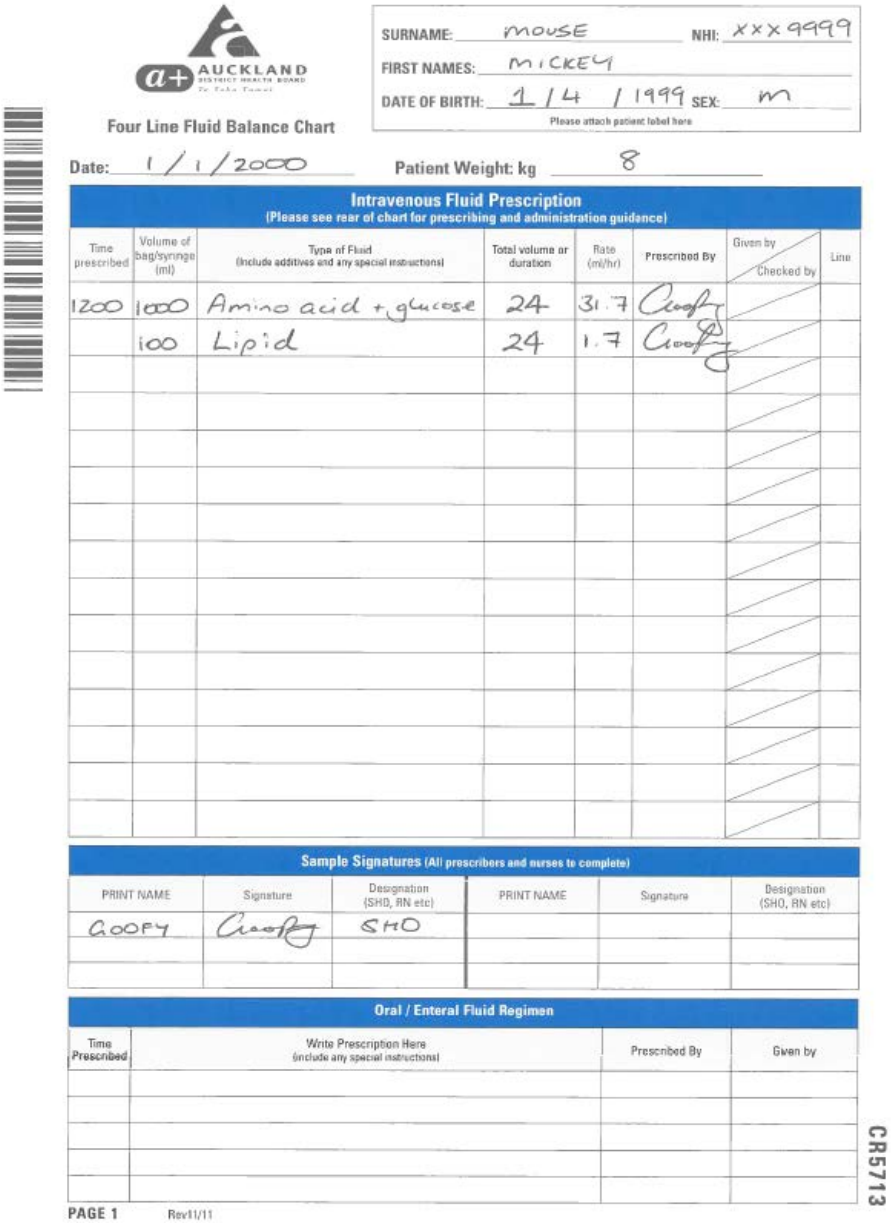
Pharmacist screen	Name:	Signature:	Locator:
Pharmacist dispense	Name:	Signature:	Date/Time:
Pharmacist check	Name:	Signature:	Date/Time:

Nursing instructions

1. Check the Day 1 Star IVN and lipid order as per the Paediatric Day 1 Star IVN Bag Guideline
2. Day 1 Star IVN bag:
Use the Alaris in-line filtration [0.2micron filter] giving set CODE: 60033E
Expiry is 48 hours Write start time and date on the Day 1 Star IVN bag label

3. Clinoleic 20% lipid bag:
Do NOT use 0.2 micron in-line filtration. Use the Alaris low sorbing blue giving set CODE: 63260NY
Expiry is 24 hours Write start time and date on the lipid label
4. Check the Day 1 Star IVN and/or lipid bags are connected correctly and check the pump infusion rates against this prescription. Follow standard IVN nursing practice i.e. independent double check

Nurse's signatures 1. 2.



SURNAME: MOUSE NHI: XXX9999
FIRST NAMES: MICKEY
DATE OF BIRTH: 1 / 4 / 1999 SEX: M
Please attach patient label here

Four Line Fluid Balance Chart

Date: 1 / 1 / 2000 Patient Weight: kg 8

Intravenous Fluid Prescription
(Please see rear of chart for prescribing and administration guidance)

Time prescribed	Volume of bag/syringe (ml)	Type of Fluid (Include additives and any special instructions)	Total volume or duration	Rate (ml/hr)	Prescribed By	Given by / Checked by	Line
1200	1000	Amino acid + glucose	24	31.7	Goofy		
	100	Lipid	24	1.7	Goofy		

Sample Signatures (All prescribers and nurses to complete)

PRINT NAME	Signature	Designation (SHO, RN etc)	PRINT NAME	Signature	Designation (SHO, RN etc)
GOOFY	Goofy	SHO			

Oral / Enteral Fluid Regimen

Time Prescribed	Write Prescription Here (include any special instructions)	Prescribed By	Given by

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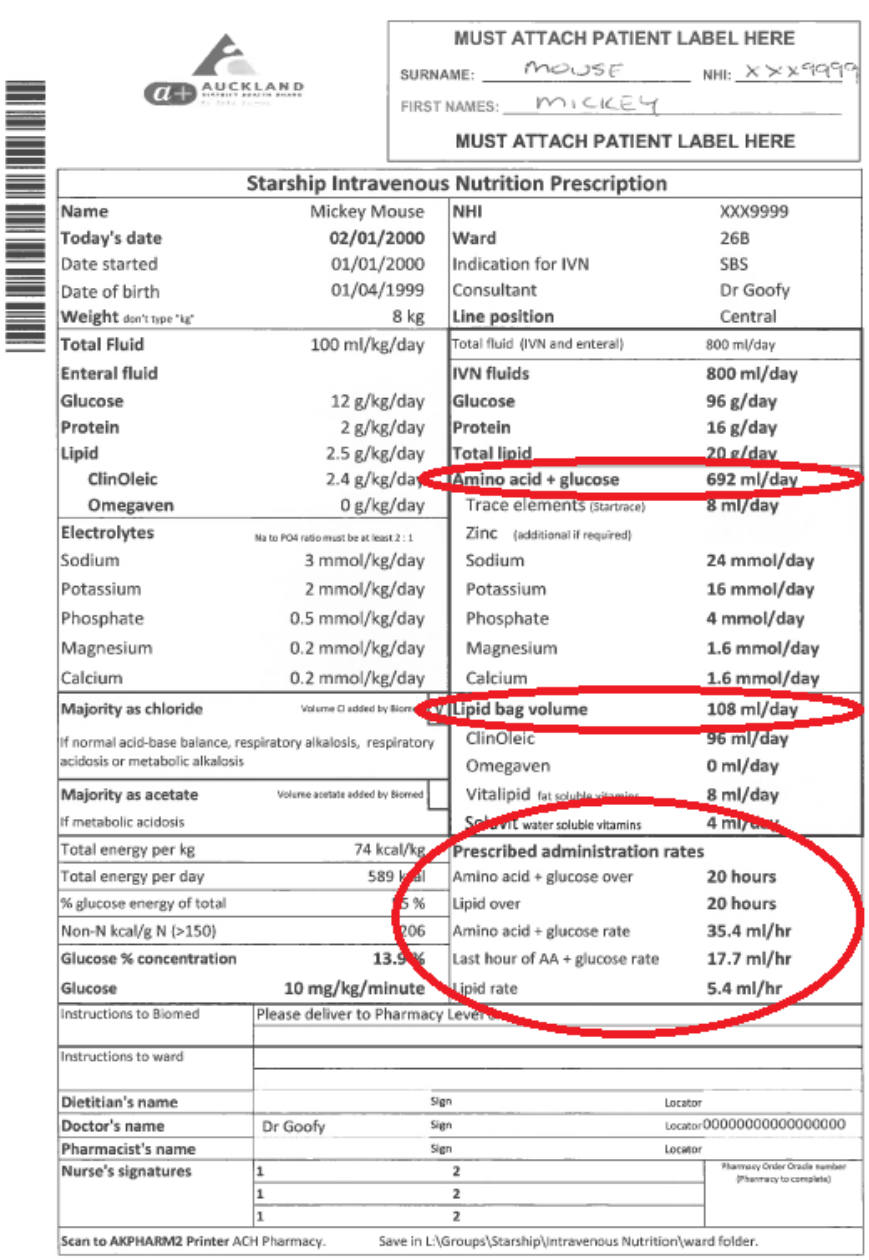
Example 2: Charting of Starship IVN Prescription



MUST ATTACH PATIENT LABEL HERE

SURNAME: MOUSE NHI: XXX9999

FIRST NAMES: MICKEY

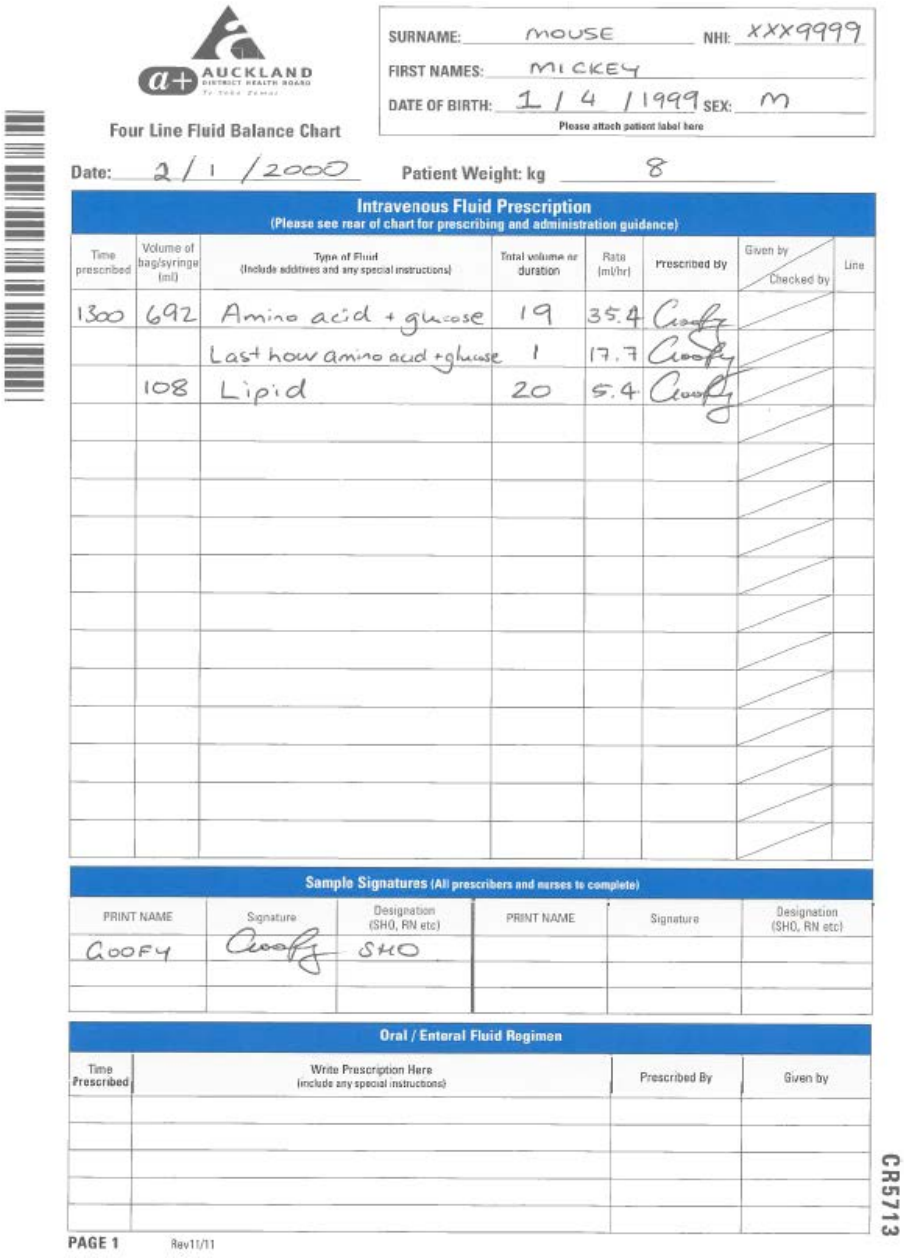
MUST ATTACH PATIENT LABEL HERE

Starship Intravenous Nutrition Prescription

Name	Mickey Mouse	**NHI**	XXX9999
Today's date	**02/01/2000**	**Ward**	26B
Date started	01/01/2000	Indication for IVN	SBS
Date of birth	01/04/1999	Consultant	Dr Goofy
Weight don't type "kg"	8 kg	**Line position**	Central
Total Fluid	100 ml/kg/day	Total fluid (IVN and enteral)	800 ml/day
Enteral fluid		**IVN fluids**	**800 ml/day**
Glucose	12 g/kg/day	**Glucose**	**96 g/day**
Protein	2 g/kg/day	**Protein**	**16 g/day**
Lipid	2.5 g/kg/day	**Total lipid**	**20 g/day**
ClinOleic	2.4 g/kg/day	**Amino acid + glucose**	**692 ml/day**
Omegaven	0 g/kg/day	Trace elements (Startrace)	**8 ml/day**
		Zinc (additional if required)	
Electrolytes	Na to PO4 ratio must be at least 2 : 1		
Sodium	3 mmol/kg/day	Sodium	**24 mmol/day**
Potassium	2 mmol/kg/day	Potassium	**16 mmol/day**
Phosphate	0.5 mmol/kg/day	Phosphate	**4 mmol/day**
Magnesium	0.2 mmol/kg/day	Magnesium	**1.6 mmol/day**
Calcium	0.2 mmol/kg/day	Calcium	**1.6 mmol/day**
Majority as chloride	Volume Cl added by Biomed	**Lipid bag volume**	**108 ml/day**
If normal acid-base balance, respiratory alkalosis, respiratory acidosis or metabolic alkalosis		ClinOleic	**96 ml/day**
		Omegaven	**0 ml/day**
Majority as acetate	Volume acetate added by Biomed	Vitalipid fat soluble vitamins	**8 ml/day**
If metabolic acidosis		SoluVit water soluble vitamins	**4 ml/day**
Total energy per kg	74 kcal/kg	**Prescribed administration rates**	
Total energy per day	589 kcal	Amino acid + glucose over	**20 hours**
% glucose energy of total	35 %	Lipid over	**20 hours**
Non-N kcal/g N (>150)	206	Amino acid + glucose rate	**35.4 ml/hr**
Glucose % concentration	**13.5 %**	Last hour of AA + glucose rate	**17.7 ml/hr**
Glucose	**10 mg/kg/minute**	Lipid rate	**5.4 ml/hr**

Instructions to Biomed	Please deliver to Pharmacy Level			
Instructions to ward				
Dietitian's name		Sign	Locator	
Doctor's name	Dr Goofy	Sign	Locator	00000000000000000
Pharmacist's name		Sign	Locator	
Nurse's signatures	1	2		Pharmacy Order Oracle number (Pharmacy to complete)
	1	2		
	1	2		

Scan to AKPHARM2 Printer ACH Pharmacy. Save in L:\Groups\Starship\Intravenous Nutrition\ward folder.



SURNAME: MOUSE NHI: XXX9999

FIRST NAMES: MICKEY

DATE OF BIRTH: 1 / 4 / 1999 SEX: M

Please attach patient label here

Four Line Fluid Balance Chart

Date: 2 / 1 / 2000 Patient Weight: kg 8

Intravenous Fluid Prescription
(Please see rear of chart for prescribing and administration guidance)

Time prescribed	Volume of bag/syringe (ml)	Type of Fluid (Include additives and any special instructions)	Total volume or duration	Rate (ml/hr)	Prescribed By	Given by / Checked by	Line
1300	692	Amino acid + glucose	19	35.4	Goofy		
		Last hour amino acid + glucose	1	17.7	Goofy		
	108	Lipid	20	5.4	Goofy		

Sample Signatures (All prescribers and nurses to complete)

PRINT NAME	Signature	Designation (SHO, RN etc)	PRINT NAME	Signature	Designation (SHO, RN etc)
GOOFY	Goofy	SHO			

Oral / Enteral Fluid Regimen

Time Prescribed	Write Prescription Here (include any special instructions)	Prescribed By	Given by

CR5713

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Example 3: Charting of All-In-One IVN Prescription

AUCKLAND DISTRICT HEALTH BOARD

MUST ATTACH PATIENT LABEL HERE

SURNAME: Mouse NHI: XXX9999

FIRST NAMES: Mickey

MUST ATTACH PATIENT LABEL HERE

All-In-One Intravenous Nutrition Prescription

Name	**Mickey Mouse**	**NHI**	**XXX9999**
Dates	**02/04/2000**	**Location**	**26B**
Days	**Monday - Sunday**	Indication for IVN	**Long term IF**
Date started	01/01/2000	Consultant	Dr Goofy
Date of birth	01/04/1999	**Line position**	**Central**
Weight don't type "kg"	**9 kg**		
Total Fluid	**90 ml/kg/day**	Total fluid (IVN + enteral)	810 ml/day
Enteral fluid		**IVN fluid volume**	**810 ml/day**
Glucose	11 g/kg/day	**Glucose**	99 g/day
Protein	2.5 g/kg/day	**Protein**	**22.5 g/day**
Lipid	2.3 g/kg/day	**Total lipid**	**20.7 g/day**
SMOF	2.2 g/kg/day	Trace elements (Startrace)	**9 ml/day**
Omegaven	0 g/kg/day	Zinc (additional if required)	
Electrolytes	Na to PO4 ratio must be at least 2 : 1	Soluvit (water soluble vitamins)	**5 ml/day**
Sodium	2 mmol/kg/day	Sodium	**18 mmol/day**
Potassium	2 mmol/kg/day	Potassium	**18 mmol/day**
Phosphate	0.3 mmol/kg/day	Phosphate	**2.7 mmol/day**
Magnesium	0.1 mmol/kg/day	Magnesium	**0.9 mmol/day**
Calcium	0.2 mmol/kg/day	Calcium	**1.8 mmol/day**
Majority as chloride	Volume Cl added by Biomed √	Vitalipid (fat soluble vitamins)	**9 ml/day**
If normal acid-base balance, respiratory alkalosis, respiratory acidosis or metabolic alkalosis		SMOF	**99 ml/day**
		Omegaven	**0 ml/day**
Majority as acetate	Volume acetate added by Biomed	Overage volume	**40 ml/day**
If metabolic acidosis		**Prescription administration**	
Total energy per kg	70 kcal/kg	IVN bag volume + 40ml overage	**850 ml**
Total energy per day	631 kcal	Volume to be infused	**810 ml**
% glucose energy of total	53 %	Ramp-up time	**0 minutes**
Non-N kcal/g N (>150)	151	Ramp-down time	**60 minutes**
Glucose % concentration	**12.2 %**	Total infusion time	**16 hours**
Glucose	**11.5 mg/kg/minute**	Infusion rate as calculated by pump	
		KVO rate	**5 ml/hr**

Instructions to Biomed				
Dietitian's name		Sign	Locator	
Doctor's name	Dr Goofy	Sign	Locator	000000000000000
Pharmacist's name		Sign	Locator	Pharmacy Order Oracle number (Pharmacy to complete)
Nurse's signatures	1	2		
	1	2		
	1	2		

AUCKLAND DISTRICT HEALTH BOARD

Four Line Fluid Balance Chart

SURNAME: Mouse NHI: XXX9999

FIRST NAMES: Mickey

DATE OF BIRTH: 1 / 4 / 1999 SEX: M

Please attach patient label here

Date: 2/4/2000 Patient Weight: kg 9

Intravenous Fluid Prescription
(Please see rear of chart for prescribing and administration guidance)

Time prescribed	Volume of bag/syringe (ml)	Type of Fluid (include additives and any special instructions)	Total volume or duration	Rate (ml/hr)	Prescribed By	Given by / Checked by	Line

All-In-One Intravenous Nutrition for HOME IVN patients for STARSHIP WARD administration

Time and Date	Prescription administration
2/4/2000 1100	Intravenous bag volume (AA/Glucose/Lipid all in one bag) + overage 850 ml Volume to be infused *(IVN fluids volume from prescription)* 810 ml Ramp-up time 0 minutes Ramp-down time 60 minutes Total infusion time 16 hours *(from prescription)* Infusion rate ____ ml/hour *(as calculated by pump)* KVO rate 5ml/hour

Doctor's name	Goofy	Signature	Goofy	Date	2/4/2000

Sample Signatures (All prescribers and nurses to complete)

PRINT NAME	Signature	Designation (SHO, RN etc)	PRINT NAME	Signature	Designation (SHO, RN etc)
Goofy	Goofy	SHO			

Oral / Enteral Fluid Regimen

Time Prescribed	Write Prescription Here (include any special instructions)	Prescribed By	Given by

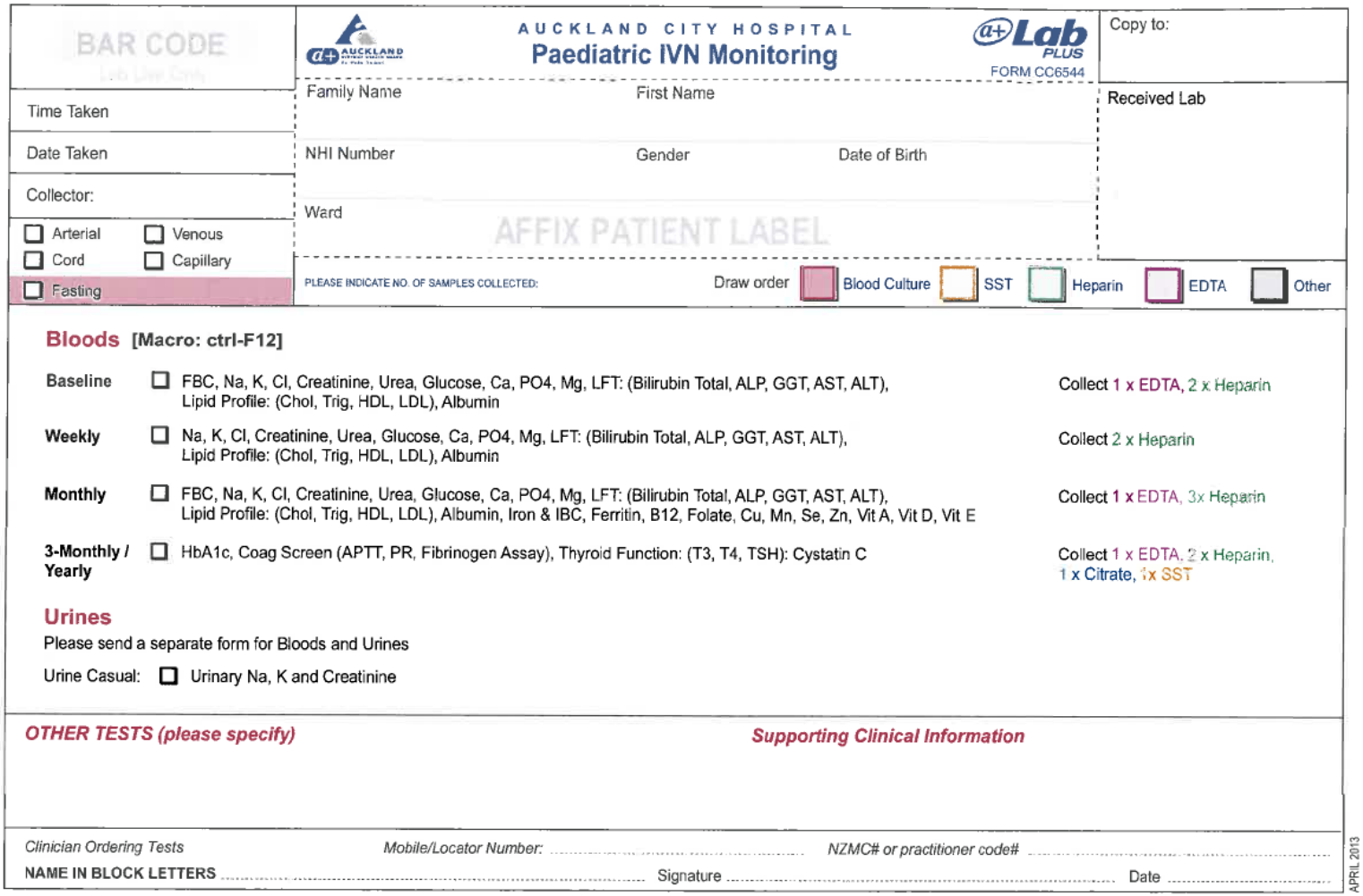
PAGE 1 Rev11/11 CR5713

Appendix 5: Troubleshooting: IVN complications

Complication	Management of Complications
Hyperlipidaemia	• Serum triglyceride > 2.5 mmol/L (infants) • Serum triglyceride > 4 mmol/L (children) • Ideally lipid profile levels are checked after 4 – 8 hours off IVN lipid *IVN Considerations* • IV lipid infusion should not exceed Infants 3 – 4 g / kg / day (0.13 – 0.17 g / kg / day) Older children 2 – 3 g / kg / day (0.08 – 0.13 g / kg / day) • Reduce IV lipid prescription as required for tolerance • Note: 0.25g / kg / day lipid for preterm infants and 0.1g / kg / day linoleic acid for infants and older children is required to prevent essential fatty acid deficiency • Use of a IV lipid emulsion with a phospholipid / triglyceride ratio at least equal to a 20% solution is used • Consider use a IV lipid emulsion which also contains MCT or omega 3 fatty acids
Hyperglycaemia	• Serum glucose > 8 - 10 mmol / L, check with finger prick blood glucose • Serum glucose consistently elevated > 10 mmol / L – check for sepsis; contact Endocrinologist • Insulin may be required where hyperglycaemia cannot be controlled. *IVN Considerations* • Ensure glucose supply is not excessive (> 75% energy from glucose) • Ensure the maximal rate of glucose infusion does not exceed the rate of glucose oxidation • Infants under 3 months should remain on 24 hour amino acid + glucose infusion
Hypoglycaemia	• Serum glucose < 3 mmol/L *IVN Considerations* • Ensure adequate glucose supply and administer continuously over 24 hours • To reduce the risk of rebound hypoglycaemia, the amino acid + glucose rate should be halved for the last hour • In the hours off IVN, check blood glucose hourly for the first 2-3 days with finger prick blood glucose in order to detect rebound hypoglycaemia • Infants aged 3 – 12 months who are not receiving enteral feeds should not be cycled off IVN for longer than 3 - 4 hours • For older children consider glucose sweets, glucose gel, sips of fruit juice during time off IVN if there is no enteral feeding
Deranged Liver Function Tests	• High ALP and GGT initially, followed by hyperbilirubinaemia *IVN Considerations* • Trophic feeding to stimulate the entero-biliary axis • Cycle IVN to reduce hyperinsulinaemia and liver steatosis • Limit glucose intake to reduce hepatic steatosis • Consider reduction of IV lipid prescription especially where co-morbidities such as sepsis or thrombocytopenia are present • SMOF is our preferred choice of lipid source • Omegaven® monotherapy can be used if liver function tests continue to deteriorate • Omegaven® and SMOF cannot be added to the same bag
Micronutrient deficiency	• Trace elements and vitamins are administered in combination and care needs to be taken when increasing dosages to treat individual deficiencies • If available, single trace elements can added to treat deficiency

	• Care needs to be taken when giving trace elements at the nutrient reference values as estimated average requirements are the estimated to meet the oral requirements of half of all healthy individuals • Long term vitamin D deficiency can result in the development IVN associated bone disease
High Micronutrient Levels	• Halve or stop trace element mixture. Consider supplementing individual trace elements as able • There is hypothetical risk of adverse effects by transient high vitamin levels. Halve or stop Vitalipid for elevated vitamin A levels • Excess water soluble vitamins in Soluvit are excreted by the kidneys and there is little toxicity **Note:** • Copper and manganese toxicity is associated with cholestasis and hepatic dysfunction • Selenium, molybdenum, zinc and chromium toxicity can be associated with renal impairment
Line sepsis	• Stop IVN (consult medical team for duration) • Start 10% glucose via a peripheral line • Keep IVN bags if stopped for sepsis, store in fridge until sent for microbiological testing

Appendix 6: Paediatric IVN monitoring laboratory form



BAR CODE
Lab Use Only

AUCKLAND CITY HOSPITAL
Paediatric IVN Monitoring
a+Lab PLUS
FORM CC6544

Copy to:

Time Taken
Date Taken
Collector:
☐ Arterial ☐ Venous
☐ Cord ☐ Capillary
☐ Fasting

Family Name First Name
NHI Number Gender Date of Birth
Ward
AFFIX PATIENT LABEL

Received Lab

PLEASE INDICATE NO. OF SAMPLES COLLECTED: Draw order ☐ Blood Culture ☐ SST ☐ Heparin ☐ EDTA ☐ Other

Bloods [Macro: ctrl-F12]

Baseline	☐ FBC, Na, K, Cl, Creatinine, Urea, Glucose, Ca, PO4, Mg, LFT: (Bilirubin Total, ALP, GGT, AST, ALT), Lipid Profile: (Chol, Trig, HDL, LDL), Albumin	Collect 1 x EDTA, 2 x Heparin
Weekly	☐ Na, K, Cl, Creatinine, Urea, Glucose, Ca, PO4, Mg, LFT: (Bilirubin Total, ALP, GGT, AST, ALT), Lipid Profile: (Chol, Trig, HDL, LDL), Albumin	Collect 2 x Heparin
Monthly	☐ FBC, Na, K, Cl, Creatinine, Urea, Glucose, Ca, PO4, Mg, LFT: (Bilirubin Total, ALP, GGT, AST, ALT), Lipid Profile: (Chol, Trig, HDL, LDL), Albumin, Iron & IBC, Ferritin, B12, Folate, Cu, Mn, Se, Zn, Vit A, Vit D, Vit E	Collect 1 x EDTA, 3x Heparin
3-Monthly / Yearly	☐ HbA1c, Coag Screen (APTT, PR, Fibrinogen Assay), Thyroid Function: (T3, T4, TSH): Cystatin C	Collect 1 x EDTA, 2 x Heparin, 1 x Citrate, 1x SST

Urines
Please send a separate form for Bloods and Urines
Urine Casual: ☐ Urinary Na, K and Creatinine

OTHER TESTS (please specify) ***Supporting Clinical Information***

Clinician Ordering Tests *Mobile/Locator Number:* ..... *NZMC# or practitioner code#* .....
NAME IN BLOCK LETTERS ..... Signature ..... Date .....

APRIL 2013

Appendix 7: Frequently asked questions

i. Ordering IVN

My patient needs to start IVN – who do I contact?

Call the ward dietitian for assistance. Even if they are not an IVN prescriber, they will be able to direct you to the right person.
Starship IVN prescriptions must be completed and scanned to Pharmacy by 11.30am to enable same day delivery of IVN.
Out of hours or on weekends, contact the on-call Paediatric Gastroenterologist and Oncall Pharmacist via switchboard

How do I order IVN?

Complete the excel forms:

1. Complete the request for IVN form
2. Either the Starship Day 1 IVN form or the Starship IVN prescription depending on your patient's requirements

The forms are located in the same file at:
L Drive/Groups/ STARSHIP/Intravenous Nutrition/Forms/Starship IVN Prescription 2014

These forms must be completed and signed off by medical staff, then scanned to pharmacy for review and ordering.

> NOTE: Use the desktop icon to access the Intravenous Nutrition folder which will be located on most computers with ward login.

It's after 12pm and my patient needs to start IVN, what do I do?

Starship IVN prescriptions received by Pharmacy after 12pm will not be ordered. New patients requiring IVN after the cut off time or at weekends will receive IVN via the Paediatric IVN Day 1 bag system. Contact your ward pharmacist or if out of hours, contact the on call pharmacist via switch.

The scanner on my ward is not working, how do I get the IVN prescription to pharmacy?

Use the Lamson tube system to send a clear photocopied version of the IVN script to pharmacy and notify your pharmacist. Please note in out of hours the Lamson tube system is deactivated for Pharmacy – it is possible to fax prescriptions in this instance.

ii Charting IVN

Who can chart IVN on the fluid balance chart?

Medical staff including House Officers, Registrars, Fellows and Consultants.
IVN is not charted by nursing staff, clinical nurse specialists, dietitians or pharmacists.

My patient's IVN is not charted on the fluid balance chart, what do I do?

During working hours, contact your medical team to chart IVN. Out of hours, contact the medical officer on call via iBLEEP.

> It is the expectation that the primary medical team responsible for the patients care will chart IVN during normal business hours. This includes weekend prescriptions.

I can't find the IVN prescription, what do I do? Where can I find another copy of the prescription?

Locate a desktop computer logged in under the ward login to access the IVN prescription via the following pathway on the L://drive:
L Drive/Groups/ STARSHIP/Intravenous Nutrition/Ward ….

Reprint the IVN prescription and label as copy. The copy will also need to be signed by the primary or oncall medical team.

iii Cycling and time off IVN

My patient's IVN is cycled, what does halving the last hour mean?

The AA / glucose rate is halved for the last hour of prescribed time to reduce rebound hypoglycaemia.

The Starship IVN prescription will calculate the hourly rate to administer the IVN, however the following calculation may also be used:

$$\text{Hourly rate} = \frac{\text{Total volume AA glucose} \times 2}{[(\text{Hours} \times 2) - 1]} \qquad \text{Last hour} = \frac{\text{Hourly rate}}{2}$$

For example, a patient is prescribed 18 hours of IVN AA + glucose, meaning the patient would get 17 hours of full rate IVN and half this rate for the 18th hour prior to stopping IVN

My patient on IVN is disconnected. Can I restart the IVN again?

IVN can be paused for up to 90 minutes and restarted again only if there is a Y connector already included in the circuit at set up and if it hasn't been disconnected.

Please include a Y connector in the circuit at set up if the need for IV antibiotics is anticipated

A new antibiotic medication is charted and IVN is needs to be stopped for infusions – what do I do?

Call your ward dietitian who can assist with changes to the IVN prescription. If IVN is already ordered, the ward dietitian can assist with recalculation of administration rates for correct charting on the fluid balance chart.

Call ward pharmacist or oncall pharmacist to assess medication compatibility.

iv IVN Administration

The IVN for my patient has finished earlier than expected. What do I do?

The patient is at risk of hypoglycaemia and may require IV fluid management, discuss with your medical team or the medical officer on-call via iBLEEP if out of business hours, with regards to additional IV fluids being required.

Notify your ward dietitian and pharmacist, who will further investigate this issue with the IVN compounding company. It is also useful to change the pump used to deliver the IVN. It is requested that the affected bag be saved for the pharmacist to take back to the compounding company.

The lines supplied with the IVN bag are not connected or damaged (including splits), what should I do?

Notify the on-call pharmacist via switch. If notified prior to 8pm, a replacement IVN bag can be remade by the compounding company if appropriate, otherwise discuss with medical officer on call via IBLEEP about ordering and prescribing appropriate IV fluids as replacement until the next IVN bag arrives.

My patient's IVN has not arrived and it is past the 6pm hang time?

Call the on-call Pharmacist via switch to discuss either locating the IVN bag or organizing another IVN bag for your patient. If neither of these options is possible, discuss the use of IV fluid replacement or a Star bag with your medical team or the on-call medical officer via IBLEEP if out of business hours.

v Titrating IVN

My patient has started enteral formula, do I need to titrate IVN, who do I call?

If enteral feeds are started for a patient receiving IVN, contact the patient's ward dietitian or prescribing dietitian for review, guidance and organization of charting with medical team.

vi Blood tests and IVN

The Dietitian has requested IVN bloods. What do they mean?

Refer to the LabPlus Paediatric IVN Monitoring form to order blood tests.

Can I take bloods off the central line?

Yes, bloods should be taken just prior to IVN commencing at 6pm to ensure accurate results.

Why are bloods done off a finger prick/micro collect?

Bloods may be taken by micro collect if there are issues with contamination in terms of clotting, there is urgent clinical need or bloods are required while IVN is running.

The lab has notified the ward about a high potassium level in my patient who is receiving IVN

If potassium level is > 6.0, pause IVN, notify medical team for IV fluid management and recheck potassium sample via micro collect. If potassium level is between 5.0 – 6.0, notify medical team.

vii Line Access and IVN

I am unable to use my patients' central line – can I give the current IVN via a peripheral line?

In general, **NO**. Contact the Paediatric Gastroenterologist on call to confirm. IVN with > 10% glucose concentration should not be given via a peripheral line.

Can the Paediatric Day 1 Star IVN bags be given via a peripheral line?

Yes, the Paediatric Day 1 Star IVN bags are < 10% glucose concentration and is therefore suitable for use via a peripheral line

viii Sepsis and IVN

My patient receiving IVN has spiked a fever. What do I do?

Refer to the Management of Suspected CVL Sepsis and Parenteral Nutrition Flowchart

ix IVN Prescription and labelling troubleshooting

The IVN has been ordered and the patient has transferred to another ward. What do I do?

Notify your ward pharmacist responsible for IVN to redirect the IVN bags for your patient

The IVN bag label differs from IVN prescription?

Call the on-call Pharmacist via switch to discuss and clarify the differences between the IVN label and prescription before administration of IVN.

The IVN label has overage, what does this mean?

All IVN bags (AA + glucose and lipid) contain overage volume to allow for priming of lines and to ensure that a small amount is left once the prescribed volume has been delivered.

x Home IVN Patients

A home IVN patient has arrived on the ward with their own IVN bags and pump. What do I do?

The medical team needs to review and chart the IVN as appropriate. Consult the clinical guidelines for charting of home IVN.

A home IVN patient is admitted and has no home IVN bags or equipment?

If prior to 12pm Monday to Friday, contact your ward dietitian or pharmacist to order IVN. If after 12pm or out of hours, discuss with your medical team or the medical officer on-call via iBLEEP with regards to IV fluid replacement.

xi NICU patient transfers

The patient transfers from NICU after 3pm in the afternoon. What do I do?

NICU patients use a different IVN system called P100, 10% dextrose and lipid syringes. The NICU should send sufficient IVN supplies to last until 6pm the following day or for the entire weekend if it is a Friday. Contact the NICU nurse specialist if there are any concerns.

The medical team will need to chart P100 + Lipid or 10% dextrose as per the NICU fluid balance chart.

Check when P100 IVN bag was started and apply a bag expiry of 72 hours. This IVN bag does not need to be changed at 6pm. Lipid syringes contain SMOF + vitamins with an expiry of 24 hours

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