



APPENDIX 2

EMERGENCY INTRAVENOUS TREATMENT FOR UREA CYCLE DISORDERS

HOW TO MAKE UP THE INFUSION

NOTE: THE FOLLOWING INSTRUCTIONS ARE FOR THE SPECIFIC CONCENTRATIONS OF MEDICINE AS LISTED BELOW – ALWAYS CHECK THE VIALS FIRST.

e.g. GIVEN THE PATIENT'S EMERGENCY IV PACK CONTAINS:

L-Arginine @ 600 mg/mL **or** L-arginine @ 500mg/mL

Sodium benzoate @ 200 mg/mL

Sodium phenylbutyrate @ 200 mg/mL

These can all be mixed together in 10% dextrose as detailed below and given at a rate of 2mls/kg/hour.

Occasionally fluid volumes may need to be reduced and given via a central line as concentrated solutions to minimise the risk of cerebral oedema. In this case the maximum concentration for infusion is 50mg/mL for sodium benzoate or sodium phenylbutyrate or 100mg/mL for arginine.

An anti-emetic may also be given if needed: eg. ondansetron

1. Guideline for OTC (ie. ornithine transcarbamylase) and CPS1 (carbamylphosphate synthase 1) deficiency:

L- arginine 100 mg/kg/day
Sodium benzoate 250 mg/kg/day
Sodium phenylbutyrate 250 mg/kg/day

Example:

To a 500 mL bag of 10% dextrose add:

- 1.75 mls of L-arginine (600mg/mL) solution **or** 2.1 mls of L-arginine (500mg/mL)
- 12.5 mls of sodium benzoate solution
- 12.5 mls of sodium phenylbutyrate solution

Run at the following rates according to weight:

Weight (kg)	40	50	60	70	80
Rate (mls/hour)	80	100	120	140	160

2. Guideline for citrullinaemia (ie. argininosuccinate synthase deficiency) and argininosuccinic aciduria (ie. argininosuccinate lyase deficiency):

L- arginine 500 mg/kg/day
Sodium benzoate 250 mg/kg/day
Sodium phenylbutyrate 250 mg/kg/day

Example:

To a 500 mL bag of 10% dextrose add:

- 8.75 mls of L-arginine (600mg/mL) solution **or** 10.5 mls of L-arginine (500mg/mL)
- 12.5 mls of sodium benzoate solution
- 12.5 mls of sodium phenylbutyrate solution

Run at the following rates according to weight:

Weight (kg)	40	50	60	70	80
Rate (mls/hour)	80	100	120	140	160

3. Guideline for arginase deficiency:

Sodium benzoate 250 mg/kg/day
Sodium phenylbutyrate 250 mg/kg/day

NO ADDITIONAL ARGININE IS GIVEN.

Example:

To a 500 mL bag of 10% dextrose add:

- 12.5 mls of sodium benzoate solution
- 12.5 mls of sodium phenylbutyrate solution

Run at the following rates according to weight:

Weight (kg)	40	50	60	70	80
Rate (mls/hour)	80	100	120	140	160

4. Guideline for N-acetylglutamate synthetase (NAGS) deficiency:

L- arginine 100 mg/kg/day
Sodium benzoate 250 mg/kg/day
Sodium phenylbutyrate 250 mg/kg/day

Example:

To a 500 mL bag of 10% dextrose add:

- 1.75 mls of L-arginine (600mg/mL) solution **or** 2.1 mls of L-arginine (500mg/mL)
- 12.5 mls of sodium benzoate solution
- 12.5 mls of sodium phenylbutyrate solution

Run at the following rates according to weight:

Weight (kg)	40	50	60	70	80
Rate (mls/hour)	80	100	120	140	160

Medications specific to NAGS deficiency: Some patients may be treated with regular oral N-carbamyl glutamate (carglumic acid, Carbaglu®). There is no intravenous preparation of N-carbamyl glutamate. If at all possible continue to give it enterally, if necessary by slow continuous infusion through a naso-gastric tube.

Additional notes:

1. *It can sometimes take a little time to prepare the intravenous medications (sodium benzoate, arginine, sodium phenylbutyrate). Do not delay in starting the intravenous dextrose 10% or in giving anti-emetics if needed – start these first whilst you are organising the other medications.*
2. *In the obese patient it may be more appropriate to give medications based on body surface area rather than body weight – contact your metabolic team for further advice.*
3. *If needed additional calories can be given as eg. intralipid 20%.*