

# Maple Syrup Urine Disease

**PRIORITY PATIENT: MUST NOT BE KEPT WAITING IN THE EMERGENCY**

## DEPARTMENT

In the event of fever, vomiting, diarrhoea or fasting  
Risk of coma, cerebral oedema

Label

**Do not wait for signs of decompensation; always initiate the following management protocol:**

### 1 EMERGENCY

Phone call only if the emergency certificate is not understood.

**Plasma amino acid chromatography (PAAC)** – green cap heparin tube; at night and weekends centrifuge and freeze plasma + assessment depending on the triggering intercurrent disease. **Serum electrolytes**, urine dipstick (ketones). Do not delay infusion. Normal results do not rule out decompensation.

### 2 START TREATMENT URGENTLY, without waiting for test results

- **NO ORAL PROTEINS or IV amino acids: stop feeding or start specific low-protein diet**
- Infuse 10% glucose with standard electrolyte supplementation\* (not 10% glucose alone)
- + Y-infusion of **20% lipids** (e.g. Medialipids, Intralipids)
- Via a peripheral line, infusion rates depending on age:

Age	0 - 24 months	2 - 4 years	4 - 14 years	> 14 years/adult	MAX. FLOW RATE
<b>10% glucose solution + added electrolytes*</b>	6 mL/kg/h (10 mg/kg/min)	5 mL/kg/h (8 mg/kg/min)	3.5 mL/kg/h (6 mg/kg/min)	2.5 mL/kg/h (4 mg/kg/min)	<u>120 mL/h (3L/24h)</u>
<b>20% lipids</b>	0.4 mL/kg/h (2 g/kg/d)	0.3 mL/kg/h (1.5 g/kg/d)	0.3 mL/kg/h (1.5 g/kg/d)	0.3 mL/kg/h (1.5 g/kg/d)	<u>20ml/h (500ml/24h)</u>

\*e.g.: Balanced electrolyte solution such as Bionolyte, B45, Glucidion. If unavailable: 10% glucose + 4 g/L NaCl (70 mEq/L) and 2 g/L KCl (27 mEq/L)

**If IV infusion is not possible** => Nasogastric tube: prepare the above IV solutions and administer via the tube at the same rates.

- In the absence of gastrointestinal disorders and if preparation is available: instead of infusion, **emergency diet** via **continuous** enteral feeding through a nasogastric tube or gastrostomy (preparation known to parents according to the dietary sheet).
- **MSUD-specific amino acid (AA) mixture is ESSENTIAL (only available for oral use):**
  - **Administer the AA mixture according to the emergency diet known to the patient.** If protocol or products are unavailable: see advice overleaf.
  - **If there is vomiting, oral feeding is not possible or there are signs of serious illness:** give this AA mixture continuously over 24 hours via NG tube
- Supplement with **VALINE** (50 mg capsules) and **ISOLEUCINE** (50 mg capsules) if available:
  - VALINE: 100 mg × 4/day (children), 200 mg × 4/day (adults).
  - ISOLEUCINE: 100 mg × 4/day (children), 200 mg × 4/day (adults).
  - **Essential after 24 hours.**
- Treat any intercurrent infection

### 3 SIGNS OF SERIOUS ILLNESS = Specialist opinion/transfer to intensive care



**Dialysis to be discussed promptly if signs of neurological involvement**

Consult **intensive care** and **metabolic specialists** to discuss continuous emergency **haemodialysis** for at least 24 hours if **coma**, **impaired consciousness**, **ataxia**, or **deterioration** in clinical condition. And/or depending on leucine levels.

- **Insert a central line to deliver concentrated infusion** (risk of cerebral oedema) while maintaining carbohydrate, lipid and sodium intake [example: 30% glucose (enough to provide the same carbohydrate intake as above), NaCl 6 g/L (100 mEq/L), potassium and calcium according to electrolytes + 0.9% sodium chloride in Y with glucose infusion, for a total of **1.5 L/m<sup>2</sup>/day** ( $Body\ surface\ area = (4W + 7)/(W + 90)$ ).
- **Maintain AA mixture continuously via NG tube**
- Continuous **haemodialysis** for at least 24 hours to avoid rebound (no intermittent dialysis).

### 4 MONITORING

- Check **GCS** and monitor for signs of serious illness every 4 hrs.
- **Capillary blood glucose every 4 hours:** target 1–1.8 g/L. If BG > 2 g/L and glycosuria is present, consider insulin 0.01 IU/kg/h, adjusted hourly.
- Urine dipstick (ketones = sign of catabolism) +/- DNPH test if **available** (1 mL urine + 1 mL DNPH) at each void until negative
- **Plasma amino acid chromatography (leucine level) once daily:** green heparin tube, send urgently to biochemistry by courier if not analysed on site. At night and weekends, centrifuge and freeze plasma, send urgently the next morning.

**PHYSIOPATHOLOGY:**

MSUD is due to a deficiency in the catabolism of branched-chain amino acids, including leucine, present in all natural proteins. Excess leucine causes endogenous intoxication, associated with gastrointestinal and neurological disorders that can progress to coma, threatening the patient's functional prognosis and even life.

Usual treatment combines:

- Strict low-protein diet: this diet excludes meat, fish and eggs entirely; other foods are allowed in strictly weighed quantities. See "maintenance diet" sheet
- An MSUD-specific amino acid mixture that is **ESSENTIAL** for patient survival. This must never be interrupted, even and especially during metabolic decompensation.
- +/- Valine and isoleucine capsules for certain patients.
- Regular monitoring of leucine levels (target 1–5 mg/dL or 100–400 µmol/L).

**ADVICE ON PREPARING THE AMINO ACID MIXTURE FOR MSUD:**

Each patient has their own AA mixture, which they should brought with them alongside the emergency diet sheet.

If the patient's AA mixture is not available, use a product available from the hospital pharmacy:

- Powdered AA mixture for MSUD (MSUD express®, MSUD 2secunda®, etc.): **make sure it is for MSUD and not another condition.**
- **2 g protein equivalent (PE)/kg/day** (not 2 g/kg powder) in divided doses every 4–6 h (max 90 g PE/24h).
- Dilute **15 g PE in 100 mL** mineral water (NB: this does not mean 15 g powder).
- For liquid AA mixtures (e.g. MSUD cooler®): no dilution required (max 6 bottles/24h).
- **If no AA mixture available in hospital, ask the family to fetch it from home immediately.**

**PROTEIN-FREE DIET: IN PARALLEL WITH THE AA MIXTURE**

- If, exceptionally, a feed/meal is missed during hospitalisation: give an emergency protein-free meal (low-protein pasta, low-protein bread with butter and jam) or, for infants: PFD1®/Energivit®: 1 measuring spoon per 30 mL water (0.7 kcal/mL).

- If the composition of the continuous emergency diet is unknown: prepare an isocaloric solution with [100 g PFD1®, Energivit® or Duocal® + 430 mL water] or [80 g maltodextrin + 20 mL oil + 425 mL water]: equivalent preparations 500 mL = 500 kcal. Adjust total intake to the patient's needs. To be reviewed with a dietitian during working hours, particularly for calcium and electrolyte intake (Na, K, etc.).

**SITUATIONS WITH RISK OF DECOMPENSATION:**

- Intercurrent infection, fever, anorexia, vomiting, surgery, excess protein intake **or any state of fasting, calorie deficit, weight loss, or catabolism.**
- **In all these cases, the patient must be hospitalised** because coma may develop rapidly. **This is an emergency:** manage the patient in the ED before inpatient admission. **ACT QUICKLY** to prevent cerebral oedema and neurological sequelae.

**CLINICAL SIGNS OF DECOMPENSATION: Do not wait for these signs to appear.**

- Acute neurological symptoms (impaired alertness, confusion, drowsiness, balance disorders, ataxia, behavioural disorders, tremors, abnormal movements, etc.)
- Or gastrointestinal symptoms (vomiting, anorexia, nausea, etc.)
- **Progression to coma +/- seizures and death or severe neurological sequelae if treatment is not initiated promptly.**

**DRUG CONTRAINDICATIONS/GENERAL ADVICE:**

**Prohibited:** No drug contraindications. Corticosteroid therapy: weigh up the indication if duration > 3 days. No restriction on the use of HSHC if resuscitation is required.

- All vaccinations are recommended (particularly influenza).
- **Prolonged fasting contraindicated:** never leave the patient without carbohydrate intake (infusion or continuous enteral tube feeding). **Reintroduce the oral amino acid mixture as soon as possible.**
- **Do not leave the patient without protein intake for more than 3 days.** Remember vitamin and trace element supplementation if the patient is on exclusive parenteral nutrition. Emergency treatment must be reviewed with the metabolic specialist during the day.
- **In the event of hospitalisation** (or emergency consultation): patients must bring their usual treatments and any special products they have with them to prepare an emergency diet.

**SURGERY with General Anaesthesia:**

**CAUTION: never leave the patient fasting without an infusion. Apply the emergency protocol with the above infusion in preparation for surgery.**

**REFERRING PHYSICIANS AND NUMBERS:**

At night, only medical teams may call in emergencies and only if the emergency certificate is not understood or if the clinical condition or test results are concerning. Whenever possible, calls should be made before nightfall.

Administrative questions should be addressed to the medical secretariat during the week or by email to the patient's referring metabolic specialist. Certificate issued on \_\_\_\_\_ Dr \_\_\_\_\_

