**Intravenous Aminophylline (Adults)**

Theophylline is a bronchial smooth muscle relaxant and bronchodilator. Intravenous (IV) theophylline is only available as aminophylline, which is a pro-drug of theophylline.

### Indication

Intravenous Aminophylline may be used for ACUTE exacerbation of Chronic Obstructive Lung Disease (COPD) - to be used as an adjunct to the management of exacerbations of COPD if there is an inadequate response to nebulised bronchodilators.

**Before using intravenous aminophylline for an exacerbation of COPD please consider whether patient may be a suitable for Non Invasive Ventilation.** (For example patients with hypercapnic respiratory failure and a pH <7.35)

Please discuss use of intravenous aminophylline with a SpR or Consultant as potential side effects may outweigh benefits and evidence of benefit in COPD is weak. Significant side effects include arrhythmias and we would recommend avoiding its use in patients with any significant arrhythmia such as Atrial Fibrillation.

**The loading dose is given only if life threatening features are present and if the patient is NOT already taking oral theophyllines.**

IV Aminophylline should be the first line IV therapy in patients with COPD, whereas IV aminophylline or IV salbutamol can be used for patients with asthma if they are not responding to standard treatment.

We would recommend all patients with acute asthma who are ill enough to need aminophylline IV are discussed with a SpR or consultant.

### Check the drug history

If the patient usually takes maintenance aminophylline or theophylline therapy, check the theophylline serum level on admission and omit the loading dose.

### For obese patients use IBW for dosing

- **IBW = Ideal body weight**
- **IBW (kg) for men** = \([\text{height (cm)} – 154] \times 0.9\) + 50
- **IBW (kg) for women** = \([\text{height (cm)} – 154] \times 0.9\) + 45.5

### Loading dose

- 5mg / kg aminophylline IV (max 500mg)- Write “LOADING DOSE” on the prescription
  - Add dose to 100mL of a compatible infusion fluid
  - Administer using a rate controlled infusion pump over 20 minutes

### Monitoring during the bolus dose

If a patient experiences acute adverse effects i.e. palpitations, tachycardia, hypotension, whilst the loading dose is being infused, the infusion may be stopped for 5-10 minutes or administered at a slower rate. Ideally the patient should be cardiac monitored during the loading dose for these reasons.

### Maintenance dose

- **500 micrograms / kg / hour (Elderly: 300 micrograms / kg / hour)**
  - Add 500mg to 500mL or 250mg to 250mL of a compatible infusion fluid (1mg/mL).
  - Administer using a rate controlled infusion pump.
  - **Prescribe as mg / hour NOT mL / hour**

### Maximum concentration

<table>
<thead>
<tr>
<th>Maximum concentration</th>
<th>25mg in 1ml</th>
<th>Maximum rate of administration</th>
<th>25mg per minute</th>
</tr>
</thead>
</table>

### Compatible infusion fluids

- Sodium chloride 0.9% or glucose 5%

### Adverse effects

- Arrhythmias, hypotension, tachycardia & convulsions. Signs of toxicity: nausea, palpitations, twitching and convulsions (see BNF for full list of adverse effects)

### Monitoring

- Heart rate and blood pressure monitoring should be recorded every hour for the first four hours and then every two hours if stable

### Management and dose reduction

Aminophylline infusions should be continued for at least 24 hours with review by medical staff at agreed intervals, and may be continued for a further 24-48 hours. Tachyarrhythmias tend to be the main reason for early discontinuation and therefore monitoring of potassium is essential. The aim is to reduce the infusion over a 10-12 hour period of time once stable.

It is recommended that dose reduction begin in the morning, aiming to stop the infusion by mid to late afternoon. This allows oral theophyllines (if appropriate) to be given that evening. The infusion rate should be reduced every 2 hours with a medical review late in the afternoon prior to stopping.
completely, and to confirm that oral theophyllines are to be started. If indicated the oral
theophyllines should be given at the evening drug round.

Once a decision has been made to wean off the Aminophylline the rate should be halved every 2
hours. The best time to start the weaning process is in the morning when any adverse effects can
be picked up whilst medical staff are available for review.

Therapeutic
drug monitoring

Therapeutic range  = 10 to 20 mg/L

- In patients receiving oral theophyllines prior to admission to hospital, plasma levels
  should be done before the aminophylline infusion is started.2
- Aminophylline levels should be measured 4-6 hours after the start of the intravenous
  infusion and checked on a daily basis thereafter.2
- When starting oral theophyllines after the infusion- restart at the dose as prior to
  admission (if admission dose showed therapeutic levels- adjust the dose accordingly if
  not) or if newly started at a dose of 225mg BD oral aminophylline (Hospital Formulary
  choice)
- When starting oral theophyllines after the infusion, the plasma levels should be checked
  no sooner than 2 days after the infusion has finished. This confirms that the oral dose is
  correct for the patient and not in the toxic range. This can be done whilst an inpatient or
  followed up by the GP.

Major
factors
influencing
serum
levels
Liver impairment, congestive heart failure, severe pulmonary obstruction, smoker.
Interacting medicines e.g. antibacterials (azithromycin, ciprofloxacin, clarithromycin,
erthyromycin, isoniazid, rifampicin), antifungals (fluconazole, ketoconazole), fluvoxamine,
carbamazepine, cimetidine, phenytoin, St John’s wort.
This is not an exhaustive list. Refer to the BNF or Ward Pharmacist.

Examples of
calculations

Patient 1: Weight = 70kg  Patient 45 years old

Loading dose:
5mg/kg = 5mg x 70kg = 350mg- add to 100ml of infusion fluid and administer over 20
minutes

Maintenance Dose:

500micrograms/kg/hour = 500micrograms x 70kg per hour = 35000micrograms/hr = 35mg
per hour

Add 500mg aminophylline to 500ml infusion fluid= 1mg/ml concentration

Set rate controlled infusion pump at 35ml per hour

Weaning process: halve the infusion rate every 2 hours- 35ml per hour to 18ml per hour to
9ml per hour to 4ml per hour to 2ml per hour for 2 hours then stop

Patient 2: Weight = 55kg Patient 87 years old

Loading dose:
5mg/kg = 5mg x 55kg = 275mg- add to 100ml infusion fluid and administer over 20
minutes

Maintenance dose:

300micrograms/kg/hour = 300micrograms x 55kg per hour = 16500 micrograms= 16.5mg
(17mg) per hour

Add 250mg aminophylline to 250ml infusion fluid= 1mg/ml concentration

Set rate controlled infusion pump at 17ml per hour

Weaning process: halve the infusion rate every 2 hours- 17ml per hour to 8ml per hour to
4ml per hour to 2ml per hour for 2 hours then stop

References
Ellen Sinden, PGH Pharmacy and Dr Simon Crowther, Thoracic Consultant PGH. Contributions by Laura Dollery, RBH Pharmacy, Dr David Morgan and Dr Timothy Shaw, Thoracic Consultants RBH July 2013.
Adapted with permission from guidelines by Dorset County Hospital NHS Trust (Author Christine Dodd, Clinical Pharmacy Manager) and Poole Hospital.
Review Date: September 2016