**Management of Blood Pressure in Acute Stroke**

**Contents**

1. Overview of Blood Pressure Targets in Stroke
2. Hypertension Management in Acute Stroke Algorithm (for pre-thrombolysis/thrombectomy or ICH)
3. Labetalol Bolus Algorithm & Dosing Guide
4. Labetalol Infusion Algorithm & Dosing Guide
5. IV Labetalol Bolus & Infusion Prescription Information
6. GTN Infusion Algorithm & Dosing Guide
7. IV GTN Infusion Prescription Information
8. Nursing Information – LABETALOL
9. Nursing Information – GLYCERYL TRINITRATE

**1.0 Overview of Blood Pressure Targets in Stroke**

1. Ischaemic stroke patients eligible for thrombolysis and/or thrombectomy first 48 hours
   * **BP Target < 180/110mmHg**
   * 1st choice – IV labetalol bolus +/- infusion unless contraindicated (asthma, cardiogenic shock, acute heart failure, 2nd & 3rd degree heart block)
   * 2nd choice – GTN infusion
2. Primary Intracerebral haemorrhage (ICH) first 2 weeks
   * **BP Target <180/110mmHg or 20mmHg reduction from baseline**
   * Oral or NG medication (e.g. Amlodipine 5mg)
   * Consider IV in severe cases (persistent BP >220/110mmHg +/- signs of malignant hypertension ) or if oral/NG not possible
3. Ischaemic stroke without thrombolysis/thrombectomy first 2 weeks
   * **BP Target <220/110mmHg or within 10% reduction from baseline**
   * Oral/NG medication (e.g. amlodipine 5mg)
   * Consider IV in severe cases (as per ICH)or if oral/NG not possible
4. Hypertension in ischaemic stroke or ICH >2 weeks

* **Target BP <130/80mmHg**
* Consider higher target (e.g. 140-150 SBP) for those with bilateral carotid artery stenosis, frailty or severe small vessel disease
* See RCP stroke guidelines 2016 section 5.4.1 for choice of agent
* Usual anti-hypertensives should be given unless reason to withhold
* Do not lower BP if GCS is <5, poor prognosis, structural cause of haematoma, immediate surgical intervention
* Signs of malignant hypertension: Papilloedema; headache; vomiting; LVF; encephalopathy; nephropathy. Seek urgent specialist advice. Reduce MAP by only 10% per hour and <25% of baseline
* Consider urgent treatment if concurrent MI, aortic dissection or (Pre) Eclampsia

***Based on RCP Stroke Guidelines 5th Edition 2016 & locally agreed guidance***

Cathy Fall (Stroke Pharmacist)

Karen Kay (Stroke Nurse Specialist)

Dr Philip Thompson (Stroke Consultant)

Dr Yi Ng (Stroke Consultant)

Dr Alexander Gerard (Doctor)

**Hypertension Management in Acute Stroke Algorithm**

(for pre-thrombolysis/thrombectomy or ICH)

**USE IV LABETALOL INFUSION ALGORITHM**

**Adjust infusion rate to target SBP following protocols**

**Systolic BP above threshold** (for 2 consecutive readings 5min apart)

**Continue to monitor BP & HR every 15mins for 1hr, every 1hr for next 10hrs then every 3hrs for 12hrs**

**LABETALOL EFFECTIVE?**

**USE IV LABETALOL HYDROCHLORIDE BOLUS ALGORITHM**

**USE IV GLYCERYL TRINITRATE INFUSION ALGORITHM**

**LABETALOL CONTRAINDICATED?**

e.g. pulm. oedema/asthma/ bradycardia/allergy/

heartblock

**Systolic Blood Pressure above relevant threshold**

for **THREE** consecutive readings

(treat cause e.g. pain/retention)

**PARENTERAL BLOOD-PRESSURE LOWERING PROTOCOL REQUESTED BY SPECIALIST REGISTRAR OR CONSULTANT**

NO

YES

YES

NO

|  |  |
| --- | --- |
| **Stroke Classification** | **BP Target** |
| Ischaemic stroke for thrombolysis and/or thrombectomy, or ICH | < 180/110 |

NO

YES

**Labetalol *Boluses* Algorithm in Acute Stroke & Dosing Guide**

**Target BP:**

**Consider starting IV INFUSION of Labetalol or GTN**

YES

NO

**Continue to monitor BP & HR every 15mins for 1h, every 1hr for 10hrs then every 3hrs for 12 hrs**

NO

YES

**After 10mins, SBP < Target?**

**Systolic Blood Pressure above relevant threshold**

for **THREE** consecutive readings (5min apart)

**Confirm target BP with registrar or consultant**

**Inject 10mg IV BOLUS LABETALOL over 2+ mins**

**(Doctor to be observing or administering)**

**Consider increasing dose (20mg) for second & third bolus**

**Measure BP 5mins and 10mins after BOLUS injection**

**(Maximal effect normally 5-10 mins, duration of action 6-18 hours)**

**3x BOLUSES GIVEN ALREADY?**

**Labetalol *Infusion* Algorithm in Acute Stroke & Dosing Guide**

**Target BP:**

**If BP > target after 30 mins at 6mg/min, contact registrar or consultant**

YES

NO

**TITRATE INFUSION RATE**

**If SBP remains above target, increase rate by 1mg/min**

(or restart at 1mg/min if infusion previouslystopped)

**Rate 6mg/min**

NO

YES

**Start INFUSION at**

**1 milligram per min**

**Systolic Blood Pressure above relevant threshold**

Following 3 consecutive readings

**Confirm target BP with registrar or consultant**

**Measure BP & HR: 5, 10, 20 & 30 mins after infusion starts**

Or after any rate change, then every 30 mins thereafter (1 hourly if no rate change for 1 hr)

**SBP < Target?**

**INFUSION RATES**

Increase infusion rates in stages, not more frequently than every 30 mins.

**1mg=1ml**

**Suggested Rates:**

1 mg/min = 60ml/h

2 mg/min = 120ml/h

3 mg/min = 180ml/h

4 mg/min = 240ml/h

5 mg/min = 300ml/h

6 mg/min = 360ml/h

No max dose- >200ml/24hr discuss with consultant

**CONTINUE INFUSION RATE**

* **If SBP is between 161-180**

**TAPER INFUSION RATE**

**(reduce by 1mg/min)**

* **If SBP is between 141-160**

**STOP INFUSION**

* **If SBP <141**

Duration > 48 hours to discuss with registrar or consultant

**IV Labetalol Bolus & Infusion Prescription Information**

**ADMINISTRATION OF BOLUS:**

* Ensure full monitoring is in place (inc. continuous cardiac monitoring) before administering and that the use has been approved by a consultant stroke physician or registrar
* Measure BP 5mins and 10mins after BOLUS injection (Maximal effect normally within 5-10 minutes).
* The first bolus is given undiluted as a fixed dose of Labetalol 10 mg over at least 2 minutes
* A second bolus may be given after 10 mins if systolic BP remains above target. This dose can be either 10 mg or 20 mg, based on clinical judgement
* A third bolus may be given 10 mins after the second, again 10-20mg, may be used
* The prescription of labetolol must be on the main drug chart

**Switching to infusion:**

* A labetolol infusion may be used if BP still above target after 3 bolus injections

Indications: hypertension associated with acute ischaemic stroke in patients undergoing thrombolysis and/or thrombectomy (target <180 mmHg SBP) or ICH (<180 mmHg SBP or <20mmHg from baseline)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Date | Drug  Approved Name  (BLOCK LETTERS) | Dose | Route | Time to be given | Prescriber name and signature | Bleep | Given by | Date and time given | For Pharmacy Use | |
| **1/1/19** | **LABETALOL** | **10 mg** | **IV** | **12:00** | **Dr J Smith**  **JS** | **8008** | **SN** | **1/1/19 12:00** |  | |
|  | **Please give over ≥2min** | |  |  |  |  |  |  |  | |
| **\*Max bolus dose in 24 hours is 200mg** | | | | | | | | | |

LABETOLOL BOLUS PRESCRIPTION EXAMPLE

**ADMINISTRATION OF INFUSION:**

* Ensure continuous ECG monitoring
* Infusion site should be checked regularly for redness
* Standard starting rate is **1 mg per minute or 60 ml per hour**
* Do not increase rate more than every 30 mins (rate reductions may be made more frequently)
* Do not increase rate by more than 1 mg/min (60ml/hr) at each stage (max rate 6 mg/ min or 360ml/hr)
* Check BP 5, 10, 20 and 30 mins post any rate change
* Then, if no further rate change is required, recheck BP every 30 mins
* If the infusion rate has been unchanged for over 1 hour the BP can now be checked hourly
* If rate 6mg/min (360ml/hr) and BP not at target, contact consultant
* Maximum duration is 24 hours (for longer seek specialist advice)
* No maximum dose in 24 hours (usual dose <200mg/24 hours seek advice if >200mg)

Remove 90 ml from 250 ml bag Glucose 5% (or sodium chloride 0.9%). Add 40 ml (200 mg) Labetalol to give total volume 200 ml – therefore 1mg = 1ml infusion

PREPARATION OF SOLUTION

LABETALOL INTRAVENOUS INFUSION PRESCRIPTION EXAMPLE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | Drug Additions | |
| Date | Infusion Fluid | Volume | Drug | Dose | Rate or duration | Prescribers Signature  Name & Bleep | Time started | Given by/  checked by |
| **1/1/19** | **Glucose 5%** | **160ml** | **LABETALOL** | **200 mg (40ml)** | **Start 1mg/min** | **JS Dr J Smith 8008** | **12:00** | **SN/JS** |
| **(Adjust rate as per IV labetalol algorithm for stroke)** | | | | | | | | |
| **\*Max rate 6mg/min (no max dose in 24 hours)** | | | | | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| If systolic BP is >Target | If systolic BP is within 20mmHg below target | If systolic BP is  20-40mmHg below target | If systolic BP is >40mmHg below target |
| **Increase the Labetalol infusion rate by 1 mg/ min (60ml/hr)** | **Continue current infusion rate** | **Reduce infusion rate by 1mg/min (60ml/hr)** | **Stop Infusion** |

LABETOLOL RATE ADJUSTMENTS

**INFUSION RATES**

Increase infusion rates in stages, not more frequently than every 30 mins.

**1mg=1ml**

**Suggested Rates:**

1 mg/min = 60ml/h

2 mg/min = 120ml/h

3 mg/min = 180ml/h

4 mg/min = 240ml/h

5 mg/min = 300ml/h

6 mg/min = 360ml/h

No max dose, If >200mg/24hr discuss with consultant

**GTN Infusion Algorithm in Acute Stroke & Dosing Guide**

**Target BP:**

**If BP > target after 30 mins at 200 mcg/min, contact registrar or consultant**

YES

NO

**TITRATE INFUSION RATE**

**If SBP remains above target, increase rate by 5-10 mcg/min**

**Rate at max 200 micrograms/min**

NO

**CONTINUE INFUSION RATE**

* **If SBP is between 161-180**

**TAPER INFUSION RATE**

**(reduce by 5 mcg/min)**

* **If SBP is between 141-160**

**STOP INFUSION**

* **If SBP <141**

Duration > 48hrs hours: Discuss with registrar or consultant

YES

**Start INFUSION at**

**5 micrograms per min**

**Systolic blood pressure above relevant threshold**

for **THREE** consecutive readings

**Confirm target BP with registrar or consultant**

**Measure BP & HR: 5, 10, 20 & 30 mins after infusion starts**

Or after any rate change, then every 30 mins thereafter (1 hourly if no rate change for 1 hr)

**SBP < Target?**

**INFUSION RATES**

Increase infusion rates in stages, not more frequently than every 15 mins

**1mg=1ml**

**Suggested Rates:**

5mcg/min = 0.3ml/h

10mcg/min = 0.6ml/h

20mcg/min = 1.2ml/h

30mcg/min = 1.8ml/h

40mcg/min = 2.4ml/h

50mcg/min = 3.0ml/h

*Up to a max of 200mcg/min (12mg/h) in gradual steps*

**IV GTN Infusion Prescription Information**

Indications: hypertension associated with acute ischaemic stroke in patients undergoing thrombolysis and/or thrombectomy (target <180 mmHg SBP) or ICH (<180 mmHg SBP or <20mmHg from baseline)

GTN INFUSION PRESCRIPTION EXAMPLE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | Drug Additions | |
| Date | Infusion Fluid | Volume | Drug | Dose | Rate or duration | Prescribers Signature  Name & Bleep | Time started | Given by/  checked by |
| **1/1/19** | **-** | **-** | **GTN** | **50 mg (50ml)** | **Start 0.3ml/hr** | **JS Dr J Smith 8008** | **12:00** | **SN/JS** |
| **(adjust rate as per GTN infusion algorithm for stroke)** | | | | | | | | |
| **\*Max rate 200mcg/min or 12ml/min (no max dose in 24 hours)** | | | | | | | | |

IMPORTANT: USE A PVC FREE GIVING SET

flush with sodium chloride 0.9% at same rate as prior infusion

If the nurse administering the infusion has concerns at any time, please contact a doctor immediately for advice (ideally the prescribing doctor)

(NB BD 50mls syringes & V-green extension lines are PVC free)

**ADMINISTRATION OF INFUSION:**

* Ensure full monitoring when giving a GTN infusion (inc. continuous cardiac monitoring) and the infusion site should be checked regularly.
* The standard starting rate of GTN infusion is *5 micrograms per minute (0.3ml/hr)*.
* The standard infusion preparation is a solution of *GTN 50 mg in 50 ml solution (undiluted)*
* Do not increase rate more than every 15 minutes (rate reductions may be made more frequently)
* Rate increases should be in increments of 5-10 micrograms/min. Maximum rate 200 micrograms/ min.
* Check BP *5, 10, 20 and 30 min* post any rate change
* Then, if no further rate change is required, recheck BP after 30 mins
* If the infusion rate has been unchanged for over 1 hour (i.e. 3 previous BP checks) the BP can now be checked hourly
* If rate 200 micrograms/min and BP not controlled contact consultant

|  |  |  |  |
| --- | --- | --- | --- |
| If systolic BP is >Target | If systolic BP is within 20mmHg below target | If systolic BP is  20-40mmHg below target | If systolic BP is >40mmHg below target |
| Increase the GTN infusion rate by  5-10mcg/min | Continue current infusion rate | Reduce infusion rate by 5-10mcg/min | Stop Infusion |

GTN RATE ADJUSTMENTS

**INFUSION RATES**

Increase infusion rates in stages, not more frequently than every 30 mins

**1mg=1ml**

**Suggested Rates:**

5mcg/min = 0.3mg/h

10mcg/min = 0.6mg/h

20mcg/min = 1.2mg/h

30mcg/min = 1.8mg/h

40mcg/min = 2.4mg/h

50mcg/min = 3.0mg/h

Up to a max of 200mcg/min (12mg/h) in gradual steps

**Nursing Information – LABETALOL**

**use for Blood Pressure Management in Acute Stroke**

**PLEASE ENSURE THIS PROTOCOL IS USED UNDER THE APPROVAL**

**& SUPERVISION OF A CONSULTANT OR REGISTRAR**

**PUMP** Use the HIGH RISK volumetric pump for Labetalol Infusions.

**STANDARD INFUSION PREPARATION: 200 mg Labetalol in 200 ml**

**Instructions:**

* Remove 90 ml from a 250 ml bag of compatible fluid. Add contents of two 100 mg vials (total = 40 ml) to the fluid bag. Shake well to mix
* The resulting solution is 200mg in 200ml
* Administer using the high risk volumetric pump as per dosage protocol.
* The made up solution is stable for 24hrs at room temperature or in a fridge

**COMPATIBLE FLUIDS: When an infusion requires diluting use**

* Glucose 5% or sodium chloride 0.9%
* Do not mix or administer in the same line concomitantly with other fluids/drugs

**BEFORE ADMINISTRATION**

* Check for contraindications: Pulmonary oedema, asthma, allergy, bradycardia (pulse <60)
* Labetalol is acidic (pH 3.5 – 5.0) and can cause tissue damage (ischaemia and necrosis)
* Should be administered via a large peripheral vein
* Always check that the cannula is patent before administering labetalol by flushing with 10 ml of sodium chloride 0.9%

**MONITORING**

* Cardiac monitor
* IV BOLUS: Check BP PRE-DOSE & after 5 + 10 min AFTER BOLUS. (Max effect = 5-10min)
* INFUSION: After starting or rate-changes, check BP + HR at 5, 10, 20 and 30 minutes, for first half hour and then every 30minutes. Monitor hourly if no rate change for 1 hour
* Stop if pulse <60bpm
* Restart infusion at lowest rate if BP increases above target after previously being stopped
* For Infusions check the cannula site and adjacent area regularly, especially for the concentrated solutions. Be vigilant for signs of extravasation: site swelling or leakage, blanching or erythema of skin, infusion rate slowing or stopping; and or site burning or stinging
* If extravasation is suspected refer urgently for medical advice
* Also monitor for signs of bronchospasm, dizziness or new/worsening nausea and/or vomiting
* Patients should remain supine during infusion and 3 hours after infusion stopped if possible. If patient needs to mobilise then monitor for symptoms of hypotension (e.g. dizziness, pale)

**FLUSHING**

* INFUSION (peripheral): use sodium chloride 0.9% or glucose 5% (at same rate as infusion to avoid adverse haemodynamic effects)
* IV BOLUS: Flush with sodium chloride 0.9% or glucose 5% at same rate as initial bolus

**STORAGE**

* Made up infusions have a shelf life of 24hrs, in a refrigerator or at room temperature
* Do not make up bags in advance and avoid storing made-up infusions

**Nursing Information – GLYCERYL TRINITRATE**

**use for Blood Pressure Management in Acute Stroke**

**PLEASE ENSURE THIS PROTOCOL IS USED UNDER THE APPROVAL**

**& SUPERVISION OF A CONSULTANT OR REGISTRAR**

**PUMP:** Use a syringe pump for GTN infusions.

**INFUSION PREPARATION:** 50 mg glyceryl trinitrate in 50 ml (ready diluted)

**COMPATIBLE FLUIDS: N/A** (no dilution is required)

**BEFORE ADMINISTRATION**

* Glyceryl trinitrate binds to PVC. To prevent loss of drug it should be given using PVC-free syringes/ giving sets. The product is clearly marked to be only infused via PVC free equipment (NB BD 50mls syringes & V-green extension lines are PVC free)
* Glyceryl trinitrate has a low pH and may cause tissue damage or extravasation, therefore should be given via a large peripheral vein

**MONITORING**

* ECG Monitor
* After starting or rate-changes, check BP + HR at 5, 10, 20 and 30 minutes, for first half hour and then every 30minutes. Monitor hourly if no rate change for 1 hour
* Restart infusion at lowest rate if BP increases above target after previously being stopped
* For Infusions check the cannula site and adjacent area regularly. Be vigilant for signs of extravasation: site swelling or leakage, blanching or erythema of skin, infusion rate slowing or stopping; and or site burning or stinging.
* If extravasation is suspected refer urgently for medical advice
* Also monitor for signs of headache, dizziness, flushing, nausea, hypotension, brady- and tachycardia and flag to physician where appropriate
* After stopping the infusion the effects may abate within minutes
* Patients should remain supine during infusion and 3 hours after infusion stopped if possible. If patient needs to mobilise then monitor for symptoms of hypotension (e.g. dizziness, pallor)

**FLUSHING**

* Use sodium chloride 0.9% at same rate as the medicine was infused at to avoid haemodynamic effects

**STORAGE**

* Infusion should be used for no longer than 24 hours
* Do not make up syringes in advance