# Magnesium Sulphate for Neonatal Neuro-protection Guideline

## Guideline information

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Summary of document:
The aim of this document is to provide guidance to obstetric, midwifery, anaesthetic and neonatal staff on indications for and appropriate use of Magnesium Sulphate for neuroprotection of the fetus in women at risk of preterm birth.

Scope:
This guideline applies to all obstetrics, midwifery and neonatal staff. The guidance uses the term “woman” (pronouns she or her) to describe individuals whose sex assigned at birth was female, whether they identify as female, male or nonbinary. It is important to acknowledge it is not only people

who identify as women for whom it is necessary to access women's health and reproductive services. Therefore, this should include people who do not identify themselves as women but who are pregnant or have recently given birth. Obstetric and midwifery services and delivery of care must therefore be appropriate, inclusive and sensitive to the needs of those individuals whose gender identity does not align with the sex that they were assigned at birth.

To be read in conjunction with:
621 - Hypertension in Pregnancy Guideline – opens in new tab

Patient information:
Include links to Patient Information Library

Owning group:
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Reviews and updates:
1.0 – New Guideline
2.0 - Updated

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Magnesium Sulphate, Preterm, Neonatal Neuroprotection

# Contents

## Scope
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## Aim
The aim of this document is to:

- Provide guidance to obstetric, midwifery, anaesthetic and neonatal staff on indications for and appropriate use of Magnesium Sulphate for neuroprotection of the fetus in women at risk of preterm birth.

## Objectives
The aim of this document will be achieved by the following objectives:

- Indications for use
- Exclusion criteria
- Administration
- Monitoring
- Signs of toxicity

## Introduction
The prevalence of preterm birth is increasing. Preterm birth remains the single biggest cause of neonatal mortality and morbidity in the UK. Over 57000 babies (around 7.9 % of live births) in England and Wales in 2012 were born preterm – that is, before 37+0 weeks of pregnancy. This is an increase in prevalence from 7.5% in 2021 to 7.9% in 2022. Twenty-five percent of all cases of cerebral palsy are in infants born at less than 34 weeks of gestation.

The incidence of **cerebral palsy** decreases significantly with increasing gestational age: 14.6% at 22–27 weeks of gestation, 6.2% at 28–31 weeks, 0.7% at 32–36 weeks and 0.1% in term infants.

Administration of magnesium sulphate to women with imminent preterm birth, with or without preterm pre-labour rupture of membranes, and/or planned preterm birth for fetal or maternal indications, reduces cerebral palsy and motor dysfunction in the fetus, infant or child.

- There is evidence that magnesium sulphate, irrespective of the dose, is not tocolytic and does not suppress labour.

## Indications for use
- In women where birth is anticipated to be imminent , use magnesium sulphate for neuroprotection of the foetus, infant or child **regardless of** plurality (number of babies in utero), reason women considered to be at risk of preterm birth, parity, anticipated mode of birth and whether or not antenatal corticosteroids have been used.

  **Gestation between 24+0 and 29+6**
  **Offer** intravenous magnesium sulphate for neuroprotection of the baby to women between 24+0 and 29+6 weeks of pregnancy who are:
  - At risk of early preterm imminent birth within 24 hours.
  - Having a planned preterm birth within 24 hours.

**Gestation between 30+0 and 33+6**

**Consider** intravenous magnesium sulphate for neuroprotection of the baby for women between 30+0 and 33+6 weeks of pregnancy who are:

- At risk of early preterm imminent birth within 24 hours.
- Having a planned preterm birth within 24 hours.

**NOTE: Gestation between 23+0 and 23+6**

For women between 23+0 and 23+6 weeks of pregnancy who are in established preterm labour or having a planned preterm birth within 24 hours, discuss the use of intravenous magnesium sulphate for neuroprotection of the baby, in the context of her individual circumstances.

- **Imminent birth anticipated** within 24 hours include:
  - Women with cervical dilatation ≤4cm on speculum/vaginal examination with regular contractions
  - Women with intact membranes and positive Partosure/ Foetal fibronectin with symptoms of threatened preterm labour
  - Women with preterm rupture of membranes who are regularly contracting

- Delivery should not be delayed in order to administer antenatal magnesium sulphate for fetal neuroprotection if there are maternal and/or fetal indications for emergency delivery.

- Neonatal services in GGH have services to care for babies ≥32/40 gestation. Ensure that transferring unit is informed if magnesium sulphate has been commenced for neuroprotection and that this is documented on the All Wales In-Utero Transfer Form and PERIPrem Perinatal Passport**.**

## Exclusion Criteria

Prior to a decision to administer magnesium sulphate a full assessment of the woman should be carried out. This should include confirmation that the woman does not meet the exclusion criteria.

Exclusion criteria**;**

- Magnesium sulphate already administered for pre eclampsia / eclampsia
- Magnesium sulphate contraindicated (Myasthenia Gravis)
- Hypersensitivity to the drug, hepatic coma
- Caution in maternal renal impairment
- Fetus unlikely to benefit (severe fetal malformations or chromosomal abnormalities
- Maternal cardiac issues /avoid in those with significant cardiac conduction defects and myocardial compromise.

## Regimen of Administration

**Magnesium sulphate 50% w/v (10mL) ampoule contains**
**5g in 10mL** equivalent to magnesium **20mmol in 10mL**
Magnesium sulphate 50% must ALWAYS be diluted before use

**LOADING DOSE: 4g magnesium sulphate (16mmol) over 5 minutes**

- Draw up 4g (8mL) of magnesium sulphate 50% solution followed by 12mL of sodium chloride 0.9% into a 20mL syringe. This will give a total volume of 20mL
- Give as an IV bolus over 5 minutes administered in a syringe driver at 4mls/hour

**MAINTENANCE DOSE: 1g/hour (4mmol/hour) for 24 hours**

- Draw up 10g (20mL) of magnesium sulphate 50% solution followed by 30mL of sodium chloride 0.9% into a 50mL syringe. This will give a total volume of 50mL
- Place the 50mL syringe into a syringe driver and set the pump to run intravenously at 5 mL/hour.

- Continue infusion until delivery or 24 hours of magnesium infusion

**Place of Administration**

- Magnesium sulphate should be administered on Labour Ward where there are appropriate staff and resources for adequate maternal and fetal monitoring.

**Consideration for Administration**

- **For women at risk of imminent preterm birth,** antenatal magnesium sulphate for fetal neuroprotection should be administered as a 4g IV loading dose, over 5minutes, followed by a 1g/hr maintenance infusion until birth or for 24 hours **whichever sooner.**

- **For planned preterm birth for fetal or maternal indications,** magnesium sulphate should be started, ideally **within 4 hours** before birth, as a 4g IV loading dose, over 5 minutes, followed by a 1g/hr maintenance infusion until birth.

- If delivery before 34 weeks is anticipated to occur sooner than 4 hours, there continues to be some advantage from administration of Magnesium sulphate. Consideration should be given to administering the loading dose during the preparation for delivery.

- If urgent delivery is required for maternal/fetal compromise (e.g. fetal distress/antepartum haemorrhage) then delivery should not be delayed to administer Magnesium Sulphate.

- If antenatal magnesium sulphate has been started for fetal neuroprotection, tocolysis can be continued.

- Magnesium sulphate should be discontinued if delivery is no longer imminent or a maximum of 24 hours of therapy has been administered.

**Repeated Doses**
In the event that birth does not occur after giving magnesium sulphate for neuroprotection of the infant, and preterm birth (less than 30 weeks' gestation) again appears imminent (planned or definitely expected within 24 hours), a repeat dose of magnesium sulphate may be considered if more than 6 hours after completing the previous infusion. The decision is at the discretion of the consultant on call .

If prolonged or repeated use of magnesium sulphate occurs during pregnancy (e.g. Multiple/ repeat or use for more than 24 hours) ensure neonatal / paediatric team are informed to allow consideration of whether monitoring of the neonate for abnormal calcium and magnesium levels and skeletal adverse effects is required.

**If undergoing Inutero Transfer**
If a clinical decision is made to transfer woman to another obstetric unit:

- Give loading dose prior to transfer if time.
- Commence and continue maintenance dose until ambulance arrives.
- Stop maintenance dose during transfer.
- Reassess on arrival at tertiary unit and ensure complete handover of information/documentation is given to receiving unit.

## Monitoring and side effects

The frequency of observations may be dictated by other aspects of care, particularly whether the mother is in active labour or being prepared for elective delivery.

**Fetal Monitoring**

- Indications for fetal heart rate monitoring in women receiving antenatal magnesium sulphate for neuroprotection should follow the local fetal monitoring recommendations.
  Magnesium sulphate administration solely is not an indication for continuous CTG but should be carried out if there are clinical indications, such as severe pre-eclampsia or growth restriction.
- Interpretation of the CTG should take into account the reduced variability that is often seen with magnesium infusions

**Maternal monitoring**

- Maternal reading Base line including oxygen saturation and patellar reflexes prior to administration
- Observations, including tendon reflexes and urine output, should be carried out at a minimum of every 4 hours.

Observations may be required more frequently depending on the circumstance e.g. in severe pre-eclampsia.

NOTE: Beware of the cardiac effects of MgSO4, which may include hypotension and arrhythmias. If concerned, consider ECG.

**Side effects**

### Maternal

Serious side effects are rare and include hypotension, respiratory depression and tachycardia

Less serious side effects include:

- Headaches,
- Nausea and vomiting
- feeling of warmth
- Sweating
- Flushing,
- Pain at infusion site.

### Fetal

Serious side effects are **very** rare but babies with hypermagnesemia can experience hypotonia/ hyporeflexia and apnoea leading to poor sucking and rarely respiratory depression. This effect lasts for up to 24 hours following birth.

The neonatal team should be aware the mother has had Magnesium Sulphate and whether treatment has been prolonged or repeated. The responsible midwife at birth should inform the Paediatric team and ensure details are documented in the PERIPrem Passport

## Potential Interactions

There is a potential theoretical interaction between magnesium sulphate and **Nifedipine** of hypotension and neuromuscular blockade effects, although this is seldom reported in clinical practice. Regular monitoring of the woman is recommended.

If hypotension occurs, Nifedipine and magnesium sulphate should cease and the woman reviewed by a medical practitioner.

**Stop the infusion and get prompt review (call Obstetrician, Anaesthetist and Senior Midwife) if:**

- Respiratory rate decreases more than 4 breaths per minute below baseline, or is less than 12 breaths per minute
- Patellar reflexes are absent (remember to check elbow reflexes in patients with epidural anaesthesia)
- Cardiac Arrhythmia
- Urine output is less than 100mls in 4 hours
- Oxygen saturations fall below 90% (start oxygen therapy)

**Magnesium Toxicity**

Magnesium Toxicity is unlikely with this regime and serum Mg levels do not need to be **routinely** measured as long as woman has normal urine output/normal renal function.

In women with renal compromise, serum magnesium monitoring is recommended.

With magnesium overdose, vital functions are lost in the following sequence:

- Loss of tendon reflexes
- Somnolence (state of drowsiness, strong desire to fall asleep, cognitively impaired, lack of ability to pay attention)
- Respiratory depression

- Paralysis
- Cardiac arrest

**Overdose / Toxicity**

If Toxicity is suspected, immediately stop the Magnesium Sulphate Infusion and take bloods for serum Magnesium levels.

| **Symptoms** | **Mg level(mmol/L)** |
|---|---|
| Therapeutic range | 2-4 |
| Loss of tendon reflexes, weakness, feeling of warmth, flushing, drowsiness, double vision, slurred speech. | 5 |
| Muscle Paralysis, respiratory arrest | 6-7.5 |
| Cardiac Arrest | >12 |

Overdose is treated with 10 ml of 10% Calcium Gluconate IV over 10 minutes via a syringe driver pump.

## Auditable Standards

1. All women in whom 'opportunistic' magnesium sulphate is considered.
2. Management plan to include use of MgSO4 to prevent neurological damage
3. Neonatal outcome in preterm infants

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