Magnesium
Newborn use only

2025

Alert	1 mmol of elemental magnesium = 24.3 mg of elemental magnesium. 1000 mg magnesium **sulfate** = 98 mg elemental magnesium = 4.1 mmol (8 mEq) of elemental magnesium. 500 mg magnesium **aspartate** = 37.4 mg elemental Mg = 1.5 mmol (3 mEq) of elemental magnesium. Intravenous doses should be diluted to a concentration of magnesium 20% or less. Calcium chloride/calcium gluconate should be available to reverse adverse effects.
Indication	Hypomagnesaemia (acute and chronic). Pulmonary hypertension when inhaled nitric oxide is not available. Perinatal asphyxia. Resuscitation of torsades de pointes. Neonatal tetany. Daily maintenance in parenteral nutrition (beyond scope of this guideline).
Action	An intracellular cation. Calcium and NMDA receptor antagonist. Magnesium is necessary for several steps in glycolysis, Krebs cycle and in protein and nucleic acid synthesis. Magnesium plays an important role in neurochemical transmission and functioning. Magnesium has an anticonvulsant effect.
Drug Type	Mineral
Trade Name	**IV** DBL Magnesium Sulfate Concentrated Injection (Pfizer) **ORAL** Bio-Logical Magnesium Complex oral liquid Clinicians Everyday health Magnesium liquid MagMin and Mag-sup (Magnesium Aspartate) tablets – Only if the above preparations are not available.
Presentation	**IV/IM:** 4.93g magnesium sulfate /10 mL ampoule (49.3% solution) OR 2.465g magnesium sulfate /5 mL. Both preparations provide 2 mmol of elemental magnesium/mL. **ORAL:** Bio-Logical Magnesium **Complex** - oral liquid. Contains 50 mg of elemental magnesium/mL. (2.06 mmol/mL of elemental magnesium). Clinicians Everydayhealth Magnesium liquid. Contains 54 mg of elemental magnesium/mL. (2.2 mmol/mL of elemental magnesium). MagMin and Mag-sup (Magnesium Aspartate) tablets. Whole tablet contains 37.4 mg of elemental magnesium (1.5 mmoL of elemental magnesium).
Dosage	**Prescribe the dose in mmol/kg of elemental magnesium (not magnesium sulfate)** **Hypomagnesaemia** **IV/IM/ORAL:** 0.1-0.2 mmol/kg of elemental magnesium. This is equivalent to: 25–50 mg/kg of magnesium **sulfate** for IV preparation. Repeat 8 hourly if necessary. Higher oral doses (0.2mmol-0.4mmol/kg/dose of elemental magnesium 6 hourly) may be used in post-op cardiac patients. **Chronic hypomagnesaemia** **ORAL:** 7.7 mmol of elemental magnesium/m^2/day in divided doses (=2500 mg magnesium aspartate/m^2/day or 3.7 mL of Bio-Logical Magnesium complex/m2/day). (ANMF Endocrine team consensus) **Body Surface Area (BSA) calculation:** $$BSA\ (m^2) = \sqrt{\frac{height\ (cm) \times weight\ (kg)}{3600}}$$

	BSA calculator links: https://amhonline.amh.net.au.acs.hcn.com.au/calculators/bodysurfacearea?menu=banner https://www.pediatriconcall.com/calculators/body-surface-area-bsa-calculator, or https://nicutools.org/#BSA **Pulmonary hypertension:** **IV:** Loading dose of 0.8 mmol/kg of elemental magnesium (200 mg/kg of magnesium sulfate) over 60 minutes followed by continuous infusion 0.08-0.2 mmol/kg/hour of elemental magnesium (20–50 mg/kg/hour of magnesium sulfate) (target serum magnesium between 3.5 and 5.5 mmol/L) **Perinatal asphyxia** **IV:** 1 mmol/kg/dose of elemental magnesium (250 mg/kg/dose of magnesium sulfate) over 60 minutes. To be commenced within 6 hours of birth. Total 3 doses at 24 hour intervals. **Torsades de pointes with pulse** **IV:** 0.1-0.2 mmol/kg of elemental magnesium (25-50 mg/kg of magnesium sulfate) over 15–20 minutes. **Pulseless torsades de pointes** **IV/Intraosseous:** 0.1-0.2 mmol/kg of elemental magnesium (25–50 mg/kg of magnesium sulfate) over several minutes. **Emergency management of tetany/convulsions/hypocalcaemic convulsions when no IV access** **IM:** 0.4 mmol/kg of elemental magnesium (100 mg/kg of magnesium sulfate). Can be repeated 12 hourly.
Route	IV, IM, oral, Intraosseous.
Preparation	**IV preparation** **Hypomagnesaemia/Torsades de pointes** Draw up 0.4 mL (0.8 mmol of elemental magnesium or 200 mg of magnesium sulfate) of 49.3% solution and add 7.6 mL sodium chloride 0.9% or glucose 5% to make a final volume of 8 mL with a concentration of 0.1 mmol/mL of elemental magnesium (25 mg/mL of magnesium sulfate). **Pulmonary hypertension IV infusion** Babies >500g: Draw up 4 mL (8 mmol of elemental magnesium or 2000 mg of magnesium sulfate) of the 49.3% solution and add 16 mL of sodium chloride 0.9% or glucose 5% to give a final volume of 20 mL with a concentration of 0.4 mmol/mL of elemental magnesium (100 mg/mL of magnesium sulfate). 0.2 mmol/kg/hr = 0.5 mL/kg/hr Babies <500g: Draw up 2 mL (4 mmol of elemental magnesium or 1000mg of magnesium sulfate) of the 49.3% solution and add 18 mL of sodium chloride 0.9% or glucose 5% to make a final volume of 20 mL with a concentration of 0.2 mmol/mL of elemental magnesium (50 mg/mL of magnesium sulfate). 0.2 mmol/kg/hr = 1 mL/kg/hr **Perinatal asphyxia** Draw up 2 mL (4 mmol of elemental magnesium or 1000 mg of magnesium sulfate) of the 49.3% solution and add 8 mL of sodium chloride 0.9% or glucose 5% to give a final volume of 10mL with a concentration of 0.4 mmol/mL (100 mg/mL of magnesium sulfate)

	ORAL preparation Bio-Logical Magnesium Complex oral liquid – No preparation is required. Clinicians Everyday health Magnesium liquid – No preparation is required. MagMin and Mag-sup (Magnesium Aspartate) tablets – Crush the tablet, disperse in 5 mL of sterile water to make 0.3 mmol of elemental magnesium in 1 mL.
Administration	**IV** IV for hypomagnesaemia: Infuse over 30–60 minutes. IV loading dose for pulmonary hypertension: Administer over 60 minutes. IV dose for perinatal asphyxia: Administer over 60 minutes. Torsades de pointes: Administer the preparation over several minutes to 20 minutes. **ORAL** Administer with or immediately after feeds. If administering via gastric tube, flush the tube to prevent blockage.
Monitoring	IV: Continuous ECG/cardiorespiratory monitoring, continuous or 2-4 hourly blood pressure. Both IV and Oral: Monitor magnesium concentrations.
Contraindications	Heart block, myocardial damage.
Precautions	Use with caution in renal impairment.
Drug Interactions	Concurrent use with paralysing agents may enhance neuromuscular blockade (e.g. succinylcholine, vecuronium, rocuronium, etc). Concomitant use with aminoglycosides may cause neuromuscular weakness (respiratory arrest). Concurrent use with nifedipine may result in exaggerated hypotensive response.
Adverse Reactions	Hypotension, bradycardia and circulatory collapse with rapid infusion. ECG changes (prolonged AV conduction time, sino-atrial block, AV block). Calcium chloride/calcium gluconate should be available to reverse adverse effects. (Refer to overdose section) Flushing, sweating, respiratory depression (particularly with higher plasma concentrations), abdominal distension, diarrhoea, urinary retention, CNS depression, muscle relaxation, hyporeflexia.
Overdose	Respiratory support as needed. Consider Calcium IV or IO: Elemental Calcium - 0.15 mmol/kg (= 0.2mL/kg of UNDILUTED 10% calcium chloride). Repeat as necessary. AUSTRALIA: Contact the Poisons Information Centre on 13 11 26 for information on the management of overdose NEW ZEALAND: Contact the National Poisons Centre on 0800 764 766 for information on the management of overdose.
Compatibility	**Fluids:** Sodium chloride 0.9%, sodium chloride 0.45%/glucose 4%, glucose 5%, parenteral nutrition glucose amino acid solution. **Y site:** Acetaminophen, Aciclovir, adrenaline (epinephrine), alfentanil, amifostine, amikacin, ampicillin, atenolol, atracurium, atropine, azithromycin, aztreonam, bivalirudin, calcium gluconate, caspofungin, cefiderocol, cefotaxime, cefoxitin, ceftazidime, ceftizoxime, chloramphenicol, cisatracurium, clindamycin, clonidine, cloxacillin, dexmedetomidine, digoxin, diltiazem, dobutamine, dopamine, esmolol, epinephrine (adrenaline), epoietin alfa, fentanyl, fluconazole, fluorouracil, folic acid, Fosfomycin, fosphenytoin, gentamicin, glycopyrrolate, heparin sodium, insulin, ketamine, labetalol, leucovorin, lidocaine, linezolid, lorazepam, meropenem, meropenem/vaborbactam, metronidazole, micafungin, midazolam, milrinone, morphine sulfate, multivitamin, netilmicin, nicardipine, nitroglycerine, norepinephrine (noradrenaline), octreotide, ondansetron, pamidronate, pancuronium, papaverine, penicillin G potassium and sodium, phenobarbital, phenylephrine, piperacillin, piperacillin-tazobactam (EDTA-free), potassium acetate, potassium chloride, procainamide, protamine, pyridoxine, remifentanil, rocuronium, sodium acetate, sodium bicarbonate, sodium nitroprusside, succinylcholine, trimethoprim-sulfamethoxazole, vancomycin, tacrolimus, thiamine, ticarcillin, tobramycin, tolazoline, urokinase, valproate sodium, vancomycin, vasopressin, vecuronium, voriconazole, zoledronic acid.
Incompatibility	**Fluids:** Fat emulsion. Incompatible with soluble phosphates and with alkaline carbonates and bicarbonates. **Y site:** Aminophylline, amiodarone, amphotericin B, anidulafungin, azathioprine, calcium chloride, cefazolin, cefepime, ceftriaxone, cefuroxime, ciprofloxacin, clindamycin, cyclosporin, dexamethasone,

	diazepam, diazoxide, dicloxacillin, erythromycin lactobionate, furosemide, ganciclovir, hydralazine, indomethacin, hydrocortisone sodium succinate, indometacin, methylprednisolone sodium succinate, naloxone, pantoprazole, pentamidine, phenytoin, phosphate salts, propofol, sulfamethoxazole/trimethoprim
Stability	Change the IV preparation every 24 hours.
Storage	Store at room temperature and protect from light.
Excipients	DBL Magnesium Sulfate Concentrated Injection (Pfizer): water for injection only. MagMin Tablets (Blackmores): Carnauba Wax, colloidal anhydrous silica, croscarmellose sodium, hypromellose, macrogol 8000, magnesium stearate, microcrystalline cellulose, purified talc, sodium starch glycollate, titanium dioxide. Mag-Sup Tablets (Petrus): Carnauba Wax, crospovidone, hypromellose, macrogol 8000, magnesium stearate, microcrystalline cellulose, purified talc, silicon dioxide, sodium starch glycollate, titanium dioxide. Bio-Logical Magnesium Complex oral liquid: hydrochloric acid, potable water.
Special Comments	Serum magnesium concentrations do not reflect with whole body stores. Renally excreted.
Evidence	**Persistent pulmonary hypertension of the newborn (PPHN)** A single RCT enrolling infants with severe respiratory distress, an oxygen index ≥25 despite HFOV support, and echocardiographic evidence of PPHN assessed the effect of MgSO4 group 200 mg/kg infused over half an hour with maintenance 50-150 mg/kg/hour to attain a serum magnesium level of 5.0-7.0 mmol versus iNO group at initial concentration of 20 ppm with crossover if no response. There was no difference in the proportion of infants who responded primarily to either vasodilator ($MgSO_4$ 23.3% versus iNO 33.3%, p=1.0). Of the non-responders, 9 of 10 in the HFOV + IV $MgSO_4$ group versus 8 / 12 HFOV + iNO group responded. There was a significant difference in mortality, with 8 of 13 (62%) HFOV + IV $MgSO_4$ group versus 2 of 12 (17%) HFOV + iNO group alive at discharge (p=0.004). Infants who were administered iNO following failed $MgSO_4$ therapy were associated with a better outcome than those who were administered $MgSO_4$ following failed iNO therapy. Several small case series have reported that 37 of 42 infants with severe PPHN treated with $MgSO_4$ responded and survived to discharge. [1-4] Conclusion: The role of $MgSO_4$ in the management of PPHN is unclear. Further trials are required. (LOE II, GOR D) **Perinatal asphyxia** A systematic review [5] of RCTs that compared magnesium to control in newborns with HIE included 5 studies. [6-10] All used magnesium sulfate given within 24 hours of birth. The dose varied: 250mg/kg every 24 hours for three doses in two studies, 250mg/kg followed by two doses of 125mg/kg every 24 hours for two doses in another two studies and a single dose of 250mg/kg in one study. Magnesium was administered over 30 min in one study, over 1 hour in three studies. There was no difference in the death or moderate-to-severe neurodevelopmental disability at 18 months between the magnesium and the control groups (RR 0.81, 95% CI 0.36 to 1.84). There was significant reduction in the unfavourable short-term composite outcome (survival with abnormalities in any of the following: neurodevelopmental exam, neuroimaging or neurophysiologic studies), (RR 0.48, 95% CI 0.30 to 0.77) but no difference in mortality (RR 1.39, 95% CI 0.85 to 2.27), seizures (RR 0.84, 95% CI 0.59 to 1.19) or hypotension (RR 1.28, 95% CI 0.69 to 2.38) between the magnesium and the control groups. Conclusion: There is insufficient evidence to determine if magnesium therapy given shortly after birth to newborns with HIE reduces death or moderate-to-severe disability. The improvement in short-term outcomes without significant increase in adverse effects supports the need for further adequately powered trials to determine if there are long-term benefits of magnesium and to confirm its safety. (LOE I GOR D) The publication of 3 additional small trials is unlikely to change this conclusion. [11-14] **Refractory ventricular fibrillation (VF)/pulseless VF (pVF)/ polymorphic ventricular tachycardia (Torsade de pointes)** The ANZCOR Guideline on Medications and Fluids in Paediatric Advanced Life Support reported hypomagnesaemia may cause life-threatening ventricular tachyarrhythmia, particularly when associated with hypokalaemia. Magnesium is the preferred antiarrhythmic treatment for polymorphic ventricular tachycardia (Torsade de pointes – "Twisting of peaks") due to acquired or congenital

	prolonged QT interval syndromes [LOE IV]. Neither increased return of spontaneous circulation (ROSC) nor survival in adults has been demonstrated in treatment of VF with magnesium [LOE IV]. The intravenous or intraosseous bolus dose of magnesium sulphate is 0.1-0.2 mmol/kg followed by an infusion of 0.3mmol/kg over 4 hours. [15] **Neonatal tetany/convulsions** An RCT of oral calcium gluconate versus oral phenobarbitone versus $MgSO_4$ 0.2 mL/kg (100 mg/kg) of 50% magnesium sulfate IMI in infants with hypocalcaemic convulsions secondary to feeding with full-cream evaporated milk reported infants treated with magnesium sulphate had higher plasma-calcium concentrations after 48 hours' treatment and fewer convulsions during and after the treatment period. (LOE II GOR C/D) Magnesium levels increased from 0.59 +/- 0.17 mmol/L pre-treatment to 0.87 +/- 0.2 mmol/L post treatment. [16]
Practice points	
References	1. Chandran S, Haqueb ME, Wickramasinghe HT, Wint Z. Use of magnesium sulphate in severe persistent pulmonary hypertension of the newborn. J Trop Pediatr. 2004;50:219-23. 2. Daffa SH, Milaat WA. Role of magnesium sulphate in treatment of severe persistent pulmonary hypertension of the neoborn. Saudi Medical Journal. 2002;23:1266-9. 3. Dehdashtian M, Tebatebae K. Magnesium sulphate as a safe treatment for persistent pulmonary hypertension of newborn resistant to mechanical hyperventilation. Pakistan Journal of Medical Sciences. 2007;23:693-7. 4. Tolsa JF, Cotting J, Sekarski N, Payot M, Micheli JL, Calame A. Magnesium sulphate as an alternative and safe treatment for severe persistent pulmonary hypertension of the newborn. Archives of Disease in Childhood. 1995;72:F184-F7. 5. Tagin M, Shah PS, Lee KS. Magnesium for newborns with hypoxic-ischemic encephalopathy: A systematic review and meta-analysis. Journal of Perinatology. 2013;33:663-9. 6. Bhat MA, Charoo BA, Bhat JI, Ahmad SM, Ali SW, Mufti MU. Magnesium sulfate in severe perinatal asphyxia: a randomized, placebo-controlled trial. Pediatrics. 2009;123:e764-9. 7. Gathwala G, Khera A, Singh J, Balhara B. Magnesium for neuroprotection in birth asphyxia. Journal of Pediatric Neurosciences. 2010;5:102-4. 8. Groenendaal F, Rademaker CM, Toet MC, de Vries LS. Effects of magnesium sulphate on amplitude-integrated continuous EEG in asphyxiated term neonates. Acta Paediatr. 2002;91:1073-7. 9. Ichiba H, Tamai H, Negishi H, Ueda T, Kim TJ, Sumida Y, Takahashi Y, Fujinaga H, Minami H. Randomized controlled trial of magnesium sulfate infusion for severe birth asphyxia. Pediatrics International. 2002;44:505-9. 10. Khashaba MT, Shouman BO, Shaltout AA, Al-Marsafawy HM, Abdel-Aziz MM, Patel K, Aly H. Excitatory amino acids and magnesium sulfate in neonatal asphyxia. Brain Dev. 2006;28:375-9. 11. Gulczynska E, Gadzinowski J, Walas W, Maczka A, Talar T, Kesiak M, Caputa J, Sobolewska B. Therapeutic hypothermia enhanced by MGSO4 for hypoxic-ischemic encephalopathy in the neonates and its influence on biomarkers of asphyxia and course of hospitalization. Journal of Maternal-Fetal and Neonatal Medicine. 2014;27:221. 12. Gulczynska EMA, Gadzinowski J, Talar T, Nowiczewski M, Cyranowicz B. Therapeutic hypothermia enhanced by magnesium sulphate for hypoxic-ischemic encephalopathy in the neonates - and their influence on protein S-100B and ceruloplasmin serum concentration. Journal of Maternal-Fetal and Neonatal Medicine. 2012;25:32. 13. Hossain MM, Mannan MA, Yeasmin F, Shaha CK, Rahman MH, Shahidullah M. Short-term outcome of magnesium sulfate infusion in perinatal asphyxia. Mymensingh medical journal : MMJ. 2013;22:727-35. 14. Rahman SU, Canpolat FE, Oncel MY, Evli A, Dilmen U, Parappil H, Anabrees J, Hassan K, Khashaba M, Noor IA, Lum LCS, Siham A, Akar M, Tuzun H, Rahmani A, Rahman M, Haboub L, Rijims M, Jaafar R, Key LY, Tagin M. Multicenter randomized controlled trial of therapeutic hypothermia plus magnesium sulfate versus therapeutic hypothermia plus placebo in the management of term and near-term infants with hypoxic ischemic encephalopathy (The Mag Cool study): A pilot study. Journal of Clinical Neonatology. 2015;4:158-63.

15. ANZCOR Guideline 12.4 – Medications and Fluids in Paediatric Advanced Life Support. https://resus.org.au/wpfb-file/anzcor-guideline-12-4-medications-and-fluids-aug16-pdf/; downloaded 19/04/2018. 2016.
16. Turner TL, Cockburn F, Forfar JO. Magnesium therapy in neonatal tetany. Lancet. 1977;1:283-4.
17. MerativeTM Micromedex® Complete IV Compatibility (electronic version). Merative, Ann Arbor, Michigan, USA. Available at: https://www.micromedexsolutions.com/ (cited: July/31/2025).

VERSION	DATE
Original 1.0	24/08/2016
Version 1.2	19/04/2018
Version 2.0	4/11/2021
Version 3.0	4/07/2024
Current 4.0	31/07/2025
REVIEW	31/07/2030

Authors Contribution of the current version

Author/s	Srinivas Bolisetty, Mohammad Irfan Azeem, Bhavesh Mehta
Evidence Review(original)	David Osborn
Expert review	
Nursing Review	Bryony Malloy, Samantha Hassall, Renae Gengaroli
Pharmacy Review	Kerrie Knox, Mohammad Irfan Azeem
ANMF group contribution	Nilkant Phad, Rebecca Barzegar, Rebecca O'Grady, Cindy Chen, Thao Tran, Celia Cunha Brites, Susannah Brew, Renae Gengaroli, Samantha Hassall, Bryony Malloy, Jutta van den Boom, Amber Seigel, Tiffany Kwan, Charles Tian, Emma Watson, Hannah Turton
Final editing	Srinivas Bolisetty
Electronic version	Thao Tran, Cindy Chen, Ian Callander
Facilitator	Srinivas Bolisetty