

<b>Alert</b>	<p>Dexamethasone is available as Dexamethasone phosphate or dexamethasone sodium phosphate.</p> <p>The conversion factor for dexamethasone: 1.2 mg dexamethasone phosphate = 1 mg dexamethasone 1.3 mg dexamethasone sodium phosphate = 1 mg dexamethasone</p> <p>There is a non TGA registered commercial product, Dexsol®oral syrup. However, a SAS form is required for supply.</p>
<b>Indication</b>	<p>To facilitate weaning from assisted ventilation and improve lung function in infants at risk of chronic lung disease. To facilitate extubation.</p>
<b>Action</b>	<p>Long acting glucocorticoid with potent anti-inflammatory action. No significant mineralocorticoid activity.</p>
<b>Drug type</b>	Adrenal steroid hormone.
<b>Trade name</b>	<p>IV: (1) DBL Dexamethasone sodium phosphate Pfizer, (2) DBL dexamethasone phosphate Hospira, (3) dexamethasone phosphate Alphapharm, (4) dexamethasone phosphate Mylan.</p> <p>Oral: Compounded by pharmacy in-house. Refer to special comments section. There is a non TGA registered commercial product, Dexsol®oral syrup. However, a SAS form is required for supply.</p>
<b>Presentation</b>	<p>IV preparations: All 4 IV preparations: 1 mL contains 4.4 mg of dexamethasone sodium phosphate equivalent to 4 mg dexamethasone phosphate and 3.4 mg of dexamethasone base. Oral: 0.05mg/mL, 0.1mg/mL, 0.5 mg/mL or 1 mg/mL solution or suspension – Prepared by pharmacy in-house. Refer to special comments section for further information.</p>
<b>Dose</b>	<p><b>Low dose (DART) protocol</b> 0.075 mg/kg/dose 12 hourly for 3 days then, 0.05 mg/kg/dose 12 hourly for 3 days then, 0.025 mg/kg/dose 12 hourly for 2 days then, 0.01 mg/kg/dose 12 hourly for 2 days then cease.</p> <p><b>High dose protocol – e.g., for term neonates with chronic lung disease</b> 0.25 mg/kg/dose 12 hourly for 3 days then, 0.15 mg/kg/dose 12 hourly for 3 days then, 0.1 mg/kg/dose 12 hourly for 3 days then, 0.05 mg/kg/dose 12 hourly for 3 days then, 0.025 mg/kg/dose 12 hourly for 6 days then cease.</p> <p><b>Extubation protocol</b> 0.25 mg/kg 8 hourly for up to 3 doses. Commence 4 hours before extubation.</p>
<b>Dose adjustment</b> Therapeutic hypothermia ECMO Renal impairment Hepatic impairment	<p>Not applicable Not applicable Not applicable Not applicable</p>
<b>Maximum dose</b>	0.75 mg/kg/day
<b>Total cumulative dose</b>	<p>Low dose (DART) protocol: 0.89 mg/kg High dose protocol: 3.6 mg/kg Extubation protocol: 0.75 mg/kg</p>
<b>Route</b>	IV, oral.
<b>Preparation</b>	<p><b>IV:</b> Note: 4.4mg/mL of dexamethasone sodium phosphate = 4mg/mL of dexamethasone phosphate equivalent to 3.4mg/mL Dexamethasone.</p>

	<p>Draw up 0.6 mL (equivalent to 2 mg dexamethasone) and add 9.4 mL of sodium chloride 0.9% to make a final volume of 10 mL with a concentration of 0.2 mg/mL. If volume is too small, further dilute: Draw up 1 mL of solution (0.2mg of dexamethasone) and add 9 mL of sodium chloride 0.9% to make a final volume of 10mL with a concentration of 0.02 mg/mL.</p> <p><b>Oral:</b> Prepared by pharmacy in-house (check which strength is stocked with Pharmacy Department). Strengths available: 0.05mg/mL oral solution or suspension 0.1mg/mL oral solution or suspension 0.5mg/mL oral solution or suspension (if volume is too small, further dilute: Draw up 1mL of solution or suspension (0.5mg dexamethasone) and add 9mL WFI to make a final volume of 10mL with a concentration of 0.05mg/mL). 1mg/mL oral solution or suspension (if volume is too small, further dilute: Draw up 1mL of solution or suspension (1mg dexamethasone) and add 9mL WFI to make a final volume of 10mL with a concentration of 0.1mg/mL).</p> <p>Dexamethasone 1mg = Dexamethasone phosphate 1.2mg = Dexamethasone sodium phosphate 1.3mg approx. Molecular mass (Dexamethasone phosphate) = 472.4 Molecular mass (Dexamethasone) = 392.5<sup>12</sup></p>
<b>Administration</b>	<p>IV: Administer over 3–5 minutes.</p> <p>Oral: Administer with feeds to minimise gastric irritation. Oral Suspension: Shake the bottle well before drawing up required dose.</p>
<b>Monitoring</b>	<p>Blood glucose levels (BGLs) at least daily. When on oral feeds measure BGL only if there is glucose in urine. Blood pressure at least daily. Electrolytes.</p>
<b>Contraindications</b>	<p>Untreated systemic infections.</p>
<b>Precautions</b>	<p>Use preservative free drug where possible. Avoid early (&lt;8 days) treatment, higher dose and longer courses where possible to reduce side effects. Avoid concurrent use with NSAIDs for PDA treatment. Corticosteroids may increase susceptibility to or mask the symptoms of infection.</p>
<b>Drug interactions</b>	<p>Barbiturates, phenytoin and rifampicin may increase the metabolism of dexamethasone. Antithyroid agents may decrease the metabolism of dexamethasone.</p>
<b>Adverse reactions</b>	<p>Early (&lt; 8 days) postnatal corticosteroids cause short-term adverse effects including gastrointestinal bleeding, intestinal perforation, hyperglycaemia, hypertension, hypertrophic cardiomyopathy and growth failure. Late (after seven days) postnatal corticosteroids in high doses in particular are associated with short-term side effects including gastrointestinal bleeding, higher blood pressure, glucose intolerance, severe retinopathy of prematurity and hypertrophic cardiomyopathy. Other effects include: Hypertriglyceridemia in association with hyperinsulinism and raised free fatty acids. Increase in total and immature neutrophil counts; increase in platelet count. Adrenal insufficiency is associated with higher doses (initial &gt;0.2 mg/kg/day) longer courses (&gt;14 days) of dexamethasone. Myocardial hypertrophy and outflow obstruction may occur with higher doses and prolonged courses of dexamethasone. May increase risk of infection.</p>
<b>Compatibility</b>	<p>Fluids: Glucose 5%, sodium chloride 0.9%</p> <p>Y-site : Amino acid solutions, aciclovir, amifostine, amikacin, anidulafungin, aztreonam, bivalirudin, cisatracurium, dexmedetomidine, fentanyl, filgrastim, fluconazole, foscarnet, granisetron, heparin</p>

	sodium, hydrocortisone sodium succinate, hydromorphone, linezolid, methadone, morphine sulfate, pethidine, piperacillin-tazobactam, potassium chloride, remifentanyl, zidovudine.												
<b>Incompatibility</b>	<p>Fluids: No information.</p> <p>Y-site: Calcium chloride, calcium gluconate, caspofungin, chlorpromazine, ciprofloxacin, dobutamine, erythromycin, esmolol, gentamicin, glycopyrrolate, haloperidol lactate, labetalol, levomepromazine, magnesium sulfate, midazolam, mycophenolate mofetil, pentamidine, phentolamine, promethazine, protamine, rocuronium, tobramycin.</p>												
<b>Stability</b>	<p>IV: Diluted solution is stable for 24 hours at 2–8°C</p> <p>Oral: As per Pharmacy Department.</p>												
<b>Storage</b>	<p>Ampoule: Store below 25°C. Protect from light.</p> <p>Oral: As per Pharmacy Department – Some formulations are stored at room temperature (below 25°C) while others are stored refrigerated (2–8°C). Protect from light.</p>												
<b>Excipients</b>	<p>IV injections are brand specific, please refer to manufacturer’s information.</p> <p>DBL Pfizer: Sodium citrate dihydrate, Creatinine, Hydrochloric acid, Sodium hydroxide</p> <p>Mylan: Sodium citrate, creatinine and water for injections</p> <p>DBL Hospira: Sodium citrate dihydrate; disodium edetate; hydrochloric acid; sodium hydroxide; sodium sulfite.</p> <p>Alphapharm: Sodium citrate anhydrous and creatinine</p> <p>Oral preparations: Many preparations exist, please consult pharmacy. An example is shown below in special comments.</p>												
<b>Special comments</b>	<p><u>IV dexamethasone preparation as a straight oral administration</u></p> <p>A small study in healthy adults showed an absolute bioavailability of around 76% when dexamethasone sodium phosphate injection was administered orally undiluted and authors recommended a dose adjustment [13]. No studies have been reported in neonates.</p> <p><u>Extemporaneous preparation</u></p> <p>Example of an oral dexamethasone 0.5mg/mL extemporaneous preparation:<sup>14</sup></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Ingredients</th> <th style="width: 20%;">Brand</th> <th style="width: 20%;">Form</th> <th style="width: 30%;">Quantity</th> </tr> </thead> <tbody> <tr> <td>Dexamethasone phosphate injection 4mg/mL</td> <td>Mylan</td> <td>Ampoule</td> <td>3mL</td> </tr> <tr> <td>OraBlend</td> <td>Perrigo</td> <td>Liquid</td> <td>To 20mL</td> </tr> </tbody> </table> <p><b>Dexamethasone 1mg = dexamethasone phosphate 1.2mg</b></p> <p>Method:</p> <p>Withdraw 3mL of dexamethasone injection into a syringe using a filter needle.          Transfer the contents of the syringe into a graduated measure.          Make up to final volume with OraBlend and mix well.          Transfer the final mixture into a plastic amber bottle<sup>15</sup> and secure lid tightly. Label appropriately.          Shake the mixture before use.</p> <p>Storage: Refrigerate (2–8°C), do not freeze. Protect from light.<sup>14,15</sup></p> <p>Expiry: 28 days after preparation.<sup>14</sup></p>	Ingredients	Brand	Form	Quantity	Dexamethasone phosphate injection 4mg/mL	Mylan	Ampoule	3mL	OraBlend	Perrigo	Liquid	To 20mL
Ingredients	Brand	Form	Quantity										
Dexamethasone phosphate injection 4mg/mL	Mylan	Ampoule	3mL										
OraBlend	Perrigo	Liquid	To 20mL										
<b>Evidence</b>	<p>Efficacy:</p> <p>Late (after seven days) postnatal corticosteroids for chronic lung disease in preterm infants: corticosteroids to infants at least seven days old reduces the need for assisted ventilation and</p>												

	<p>chronic lung disease, and may reduce death in the first 28 days of life. However, high doses in particular are associated with short-term side effects such as bleeding from the stomach or bowel, higher blood pressure, glucose intolerance, severe retinopathy of prematurity and hypertrophic cardiomyopathy [1]. (LOE I, GOR B)</p> <p>A meta-regression of randomised trials of postnatal corticosteroids in preterm infants found a relationship between risk of bronchopulmonary dysplasia and risk of death or CP. With risks for CLD below 35%, corticosteroid treatment significantly increased the chance of death or CP, whereas with risks for CLD exceeding 65%, it reduced this chance. There was no difference overall in risk of death or cerebral palsy. The analysis suggests postnatal corticosteroids should be restricted to ventilated infants predicted to have <math>\geq 35\%</math> risk of bronchopulmonary dysplasia [2, 3]. (LOE III, GOR C)</p> <p>Conclusion: It is recommended to reserve the use of late corticosteroids for infants who cannot be weaned from mechanical ventilation and to minimise the dose and duration of any course of treatment [1].</p> <p>Dose: Treatment regimens varied from cumulative dexamethasone doses 0.4 mg/kg up to 8.0 mg/kg [2]. The low dose dexamethasone protocol (DART trial) facilitated extubation and shortened duration of intubation in ventilator-dependent, very preterm/extremely low birth weight infants, without obvious short-term complications. [Twice-daily doses of a 10-day tapering course of dexamethasone sodium phosphate (0.15 mg/kg per day for 3 days, 0.10 mg/kg per day for 3 days, 0.05 mg/kg per day for 2 days, and 0.02 mg/kg per day for 2 days; total of 0.89 mg/kg)] [4].</p> <p>Early (&lt; 8 days) postnatal corticosteroids for preventing chronic lung disease in preterm infants: early corticosteroid treatment facilitates extubation and reduces the risk of chronic lung disease, patent ductus arteriosus and severe retinopathy of prematurity. However, it causes short-term adverse effects including gastrointestinal bleeding, intestinal perforation, hyperglycaemia, hypertension, hypertrophic cardiomyopathy and growth failure. Long-term follow-up studies report an increased risk of abnormal neurological examination and cerebral palsy. There was no difference in infection. The benefits of early postnatal corticosteroid treatment, particularly dexamethasone, may not outweigh the adverse effects of this treatment [5]. (LOE I, GOR B)</p> <p>Intravenous dexamethasone for extubation of newborn infants: Dexamethasone reduces the need for endotracheal reintubation of neonates after a period of intermittent positive pressure ventilation. In view of the lack of effect in low risk infants and the documented and potential side effects, restrict use to infants at increased risk for airway oedema and obstruction, such as those who have received repeated or prolonged intubations. Dose regimens used 0.25-0.5 mg/kg from 1-3 doses [6]. [LOE I, GOR C]</p> <p>Other side effects:</p> <p>Adrenal suppression and myocardial hypertrophy: Higher doses (starting &gt;0.2mg/kg) and prolonged courses (&gt;14 days) may be associated with myocardial hypertrophy and adrenal suppression [7, 8]. (LOE II, GOR B)</p> <p>Infection: Systematic reviews of trials of early and late postnatal corticosteroids found no difference in infection rate overall [1, 4]. However, a crossover trial of dexamethasone-placebo versus placebo-dexamethasone reported increased nosocomial infection in the initial time period in the dexamethasone group [9].</p> <p>Neutrophils: Dexamethasone increased total and immature neutrophils and platelet count peaking on day 7 [10].</p> <p>Hypertriglyceridaemia: Dexamethasone induces hypertriglyceridemia in association with hyperinsulinism and raised free fatty acids [11].</p>
<b>Practice points</b>	
<b>References</b>	<ol style="list-style-type: none"> <li>1. Doyle LW, Ehrenkranz RA, Halliday HL. Late (&gt; 7 days) postnatal corticosteroids for chronic lung disease in preterm infants. The Cochrane database of systematic reviews. 2014;5:CD001145.</li> <li>2. Doyle LW, Halliday HL, Ehrenkranz RA, Davis PG, Sinclair JC. Impact of postnatal systemic corticosteroids on mortality and cerebral palsy in preterm infants: effect modification by risk for chronic lung disease. Pediatrics. 2005;115:655-61.</li> <li>3. Doyle LW, Halliday HL, Ehrenkranz RA, Davis PG, Sinclair JC. An update on the impact of postnatal systemic corticosteroids on mortality and cerebral palsy in preterm infants: effect modification by risk of bronchopulmonary dysplasia. The Journal of pediatrics. 2014;165:1258-60.</li> </ol>

	<ol style="list-style-type: none"> <li>4. Doyle LW, Davis PG, Morley CJ, McPhee A, Carlin JB, Investigators DS. Low-dose dexamethasone facilitates extubation among chronically ventilator-dependent infants: a multicenter, international, randomized, controlled trial. <i>Pediatrics</i>. 2006;117:75-83.</li> <li>5. Doyle LW, Ehrenkranz RA, Halliday HL. Early (&lt; 8 days) postnatal corticosteroids for preventing chronic lung disease in preterm infants. <i>The Cochrane database of systematic reviews</i>. 2014;5:CD001146.</li> <li>6. Davis PG, Henderson-Smart DJ. Intravenous dexamethasone for extubation of newborn infants. <i>The Cochrane database of systematic reviews</i>. 2001:CD000308.</li> <li>7. Bloomfield FH, Knight DB, Harding JE. Side effects of 2 different dexamethasone courses for preterm infants at risk of chronic lung disease: a randomized trial. <i>The Journal of pediatrics</i>. 1998;133:395-400.</li> <li>8. Walther FJ, Findlay RD, Durand M. Adrenal suppression and extubation rate after moderately early low-dose dexamethasone therapy in very preterm infants. <i>Early human development</i>. 2003;74:37-45.</li> <li>9. Papile LA, Tyson JE, Stoll BJ, Wright LL, Donovan EF, Bauer CR, Krause-Steinrauf H, Verter J, Korones SB, Lemons JA, Fanaroff AA, Stevenson DK. A multicenter trial of two dexamethasone regimens in ventilator-dependent premature infants. <i>The New England journal of medicine</i>. 1998;338:1112-8.</li> <li>10. Bouchier D, Weston PJ. The effect of dexamethasone upon platelets and neutrophils of preterm infants with chronic lung disease. <i>Journal of paediatrics and child health</i>. 1991;27:101-4.</li> <li>11. Amin SB, Sinkin RA, McDermott MP, Kendig JW. Lipid intolerance in neonates receiving dexamethasone for bronchopulmonary dysplasia. <i>Archives of pediatrics &amp; adolescent medicine</i>. 1999;153:795-800.</li> <li>12. www.palliativedrugs.com July 2003 newsletter.</li> <li>13. Toledo A, Amato CS, Clarke N, Reitz RE, Salo D. Injectable dexamethasone sodium phosphate administered orally? A pharmacokinetic analysis of a common emergency department practice. <i>J Pediatr Pharmacol Ther</i>. 2015;20(2):105–111. doi:10.5863/1551-6776-20.2.105</li> <li>14. Jackson M, Lowey A, eds. <i>Handbook of Extemporaneous Preparation, Dexamethasone oral liquid and dexamethasone sodium phosphate oral liquid 2010</i></li> <li>15. Chou et al., <i>Stability of Dexamethasone in Extemporaneously prepared oral suspensions</i>, Vol. 54, No.2 <i>J Can Pharm Hosp</i> 2001</li> </ol>
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