WHO recommendation on antenatal corticosteroid therapy for women at risk of preterm birth from 24 weeks to 34 weeks of gestation

17 November 2015

Recommendation

Antenatal corticosteroid therapy is recommended for women at risk of preterm birth from 24 weeks to 34 weeks of gestation when the following conditions are met:

- gestational age assessment can be accurately undertaken;
- preterm birth is considered imminent;
- there is no clinical evidence of maternal infection;
- adequate childbirth care is available (including the capacity to recognize and safely manage preterm labour and birth);
- the preterm newborn can receive adequate care if needed (including resuscitation, thermal care, feeding support, infection treatment and safe oxygen use).

(Strong recommendation based on moderate-quality evidence for newborn outcomes and low-quality evidence for maternal outcomes)

Publication history

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Updated: No update planned

Assessed as up-to-date: November 2015

Remarks

- This recommendation applies to all other recommendations relating to the use of antenatal corticosteroids in this guideline.
The recommendation is largely based on evidence derived from settings where the certainty of gestational age estimation is high. Therefore, accurate and standardized gestational age assessment (ideally from first trimester ultrasound) is essential to ensure that all eligible mothers receive corticosteroids while avoiding unnecessary treatment of ineligible mothers. Antenatal corticosteroid should not be routinely administered in situations where the gestational age cannot be confirmed, particularly when gestational age is suspected to be more than 34 weeks, as the risk of harm may outweigh the benefits if mature fetuses are exposed to corticosteroid in-utero.

Due consideration should be given to local limits of fetal viability when determining the lowest limit of gestational age when antenatal steroids should be administered, including reference to local data on newborn survival and morbidity. The GDG noted that the probability of survival without residual morbidity (“intact survival”) at < 24 weeks is low, even in high-resource settings.

The GDG acknowledged that the conditions listed above may not be operationalized in a standard and consistent manner across settings. Identifying the most critical and essential preconditions to achieve clinical benefits from antenatal corticosteroid is uncertain and would benefit from further research. In setting these preconditions, the panel’s emphasis was on minimizing harm to the mother and the baby.

An appropriate standard of childbirth care should be available to the mother in a facility that has a team of health-care providers competent in recognizing and safely managing preterm labour and imminent preterm birth. Safe care during labour and childbirth requires close monitoring of the mother and fetus to identify and appropriately manage complications, such as maternal infection and fetal hypoxia.

Essential and special care for the management of preterm newborns should be available to prevent or address any newborn complications related to prematurity or otherwise.

The GDG made a strong recommendation, having placed its emphasis on: the benefits to the preterm infants, in terms of reducing early morbidity and mortality outcomes; the low-cost and wide availability of corticosteroid globally; the feasibility of implementing the intervention; and the potential impact on health-care resource use across settings.

Background

Preterm birth, defined as birth before 37 weeks of gestation, is the single most important determinant of adverse infant outcomes, in terms of survival and quality of life. (1) Globally, it is the leading cause of perinatal and neonatal mortality and morbidity. (2) Preterm infants are particularly vulnerable to complications due to impaired respiration, difficulty in feeding, poor body temperature regulation and high risk of infection. (3-5) With the increasing contribution of neonatal deaths to overall child mortality, it is critical to address the determinants of poor outcomes related to preterm birth to achieve further reductions in child mortality. (6-8)

Infant mortality and morbidity from preterm birth can be reduced through interventions delivered to the mother before or during pregnancy, and to the preterm infant after birth. (9) Interventions can be directed at all women for primary prevention and reduction of the risk of preterm birth (e.g. smoking cessation programme) or aimed at minimizing the risk in women with known risk factors (e.g. progestational agents, cervical cerclage). (10) However, the most beneficial set of maternal interventions are those that are aimed at improving outcomes for preterm infants when preterm birth is inevitable (e.g. antenatal corticosteroids, magnesium sulfate and antibiotic prophylaxis). (9) Special care of the preterm newborn to prevent and treat complications of prematurity is also critical to newborn survival. In high-income countries, reductions in mortality rates in infants that were born preterm have been driven largely by improved care and, more importantly, by appropriate policy changes.

Methods
The recommendations were developed using standard operating procedures in accordance with the process described in the WHO handbook for guideline development (11). Briefly, these included (i) identification of priority questions and critical outcomes, (ii) retrieval of the evidence, (iii) assessment and synthesis of evidence, (iv) formulation of recommendations, and (v) planning for the dissemination, implementation, impact evaluation and updating of the guideline.

The scientific evidence underpinning the recommendations was synthesized using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach (12). Up-to-date systematic reviews were used to prepare evidence profiles for the priority questions. WHO then convened a Technical Consultation in May 2014 where an international group of experts – the Guideline Development Group (GDG) – formulated and approved the recommendations based on the evidence profiles.

In November 2014, an online consultation of the GDG was conducted to review and revise the recommendations in the light of the findings of a large implementation trial of antenatal corticosteroids in low-resource countries.

Further information on procedures for developing this recommendation are available here.

**Recommendation question**

For this recommendation, we aimed to answer the following question:

- Among pregnant women at risk of imminent preterm birth (P), is antenatal corticosteroid therapy (I), compared with no antenatal corticosteroid therapy (C), effective in reducing adverse newborn outcomes (O)?

**Evidence summary**

*Antenatal corticosteroids versus placebo or no treatment (all women and babies)*

Evidence on the use of antenatal corticosteroids for reducing adverse neonatal outcomes associated with prematurity was extracted from a Cochrane systematic review of 26 trials (4469 women and 4853 babies) (13). This review included trials that compared corticosteroid treatment with placebo or no treatment in women expected to deliver between 24 and 37 weeks of gestation as a result of either spontaneous preterm labour, preterm prelabour rupture of membranes (PPROM) or elective preterm birth. Exclusion criteria were variable but commonly included medical contraindications to steroid use, evidence of maternal infection, diabetes, lethal fetal anomalies, advanced first stage of labour, and any maternal or fetal indications requiring urgent delivery.

Most of the trials were conducted in hospital settings in high-income countries: Brazil (2 trials), Finland (2 trials), the United States of America (USA) (12 trials), and one trial each in Canada, Colombia, Jordan, the Netherlands, New Zealand, South Africa, Spain, Turkey, Tunisia and the United Kingdom. Eighteen trials used betamethasone (3028 women and 3289 babies) as the corticosteroid in the treatment arm while six trials used dexamethasone (1391 women and 1514 babies). One study did not specify the corticosteroid used (18 women and babies), and another study used either betamethasone or dexamethasone (32 women and babies). Evidence on the specific population of women whose preterm babies are most likely to benefit from
antenatal corticosteroids and those in whom there are concerns that associated risks may outweigh benefits was extracted from the subgroup analyses of the same Cochrane review. Where a specific population of interest was not included in the Cochrane review, evidence was extracted from other systematic reviews that were specifically performed for this purpose. Evidence regarding the overarching context of care specified for the main recommendation was based on the findings of a large cluster-randomized trial evaluating the effects of a population-based multifaceted strategy to increase antenatal corticosteroid coverage on neonatal mortality (14)

**Maternal outcomes**

**Severe maternal morbidity or death:** Compared with placebo, corticosteroid therapy was not associated with increased risk of maternal mortality (RR 0.98, 95% CI 0.06–15.50; 3 studies, 365 women, 1 death in each arm of the pooled results). Two studies reported maternal admission to intensive care; there was no significant difference between the groups (RR 0.74, 95% CI 0.26–2.05; 319 women).

**Maternal infectious morbidity:** Corticosteroid therapy was not associated with increased risk of maternal infection; the rates of chorioamnionitis were similar in both groups (RR 0.90, 95% CI 0.69–1.17; 13 studies, 2525 women), as were the rates of puerperal sepsis (RR 1.35, 95% CI 0.93–1.95; 8 studies, 1003 women), and postnatal fever (RR 0.92, 95% CI 0.64–1.33; 5 studies, 1323 women).

**Maternal side-effects:** No cases of maternal side-effects were reported (4 studies, 533 women).

**Fetal and neonatal outcomes**

**Fetal and neonatal death:** Compared with placebo, corticosteroid therapy was associated with significantly fewer fetal and neonatal deaths (RR 0.77, 95% CI 0.67–0.89; 13 studies, 3627 infants). This was largely due to a 32% reduction in neonatal deaths (RR 0.68, 98% CI 0.58–0.80; 21 studies, 4408 infants, corresponding to 9.5% in the treatment group versus 14% for controls), whereas fetal deaths were comparable in both groups (RR 0.98, 95% CI 0.73–1.30; 13 studies, 3627 infants). Childhood death: There were no significant differences in terms of childhood deaths (RR 0.68, 95% CI 0.36–1.27; 4 studies, 1010 children) or deaths occurring during adulthood (RR 1.00, 95% CI 0.56–1.81; 1 study, 988 adults).

**Severe neonatal morbidity:** The rate of respiratory distress syndrome (RDS) was reduced by 35% in the corticosteroids group (RR 0.65, 95% CI 0.58–0.73; 25 studies, 4590 infants). Moderate and severe RDS was also reduced (RR 0.55, 95% CI 0.43–0.71; 6 studies, 1686 infants). The mean duration of mechanical ventilation was reduced in the corticosteroids group (MD -1.42 days, 95% CI -2.28 to -0.56; 3 studies, 518 infants). Mean duration of oxygen supplementation was reported in one trial and results favoured the corticosteroids group (MD -2.86 days, 95% CI -5.51 to -0.21; 73 infants). There was no significant difference in chronic lung disease (RR 0.86, 95% CI 0.61–1.22; 6 studies, 818 infants). Corticosteroid therapy was associated with a reduction in the occurrence of cerebroventricular haemorrhage (RR 0.54, 95% CI 0.43–0.69; 13 studies, 2872 infants), infant systemic infection in the first 48 hours of life (RR 0.57, 95% CI 0.38–0.86; 6 studies, 1359 infants) and necrotizing enterocolitis (RR 0.46, 95% CI 0.29–0.74; 8 studies, 1675 infants) when compared with placebo. No significant difference between the groups was observed for small-for-gestational-age (SGA) infants (RR 1.05, 95% CI 0.78–1.42; 4 studies, 698 infants), mean infant birth weight (MD -6.93 g, 95% CI -39.41 to 25.55; 13 studies, 2961 infants), admission to a neonatal intensive care unit (NICU) (RR 0.88, 95% CI 0.73–1.06; 4 studies, 629 infants) or mean duration of NICU stay (MD 0.00, 95% CI -1.08 to 1.09; 4 studies, 641 infants).
**Long-term morbidity:** Corticosteroid therapy was associated with a trend towards a reduction in the number of children treated for cerebral palsy in childhood (RR 0.60, 95% CI 0.34–1.03; 5 studies, 904 children), as well as a reduction in developmental delay (RR 0.49, 95% CI 0.24–1.00; 2 studies, 518 children). Differences between groups for visual and hearing impairment, neurodevelopmental delay, intellectual impairment and behavioural or learning difficulties were not statistically significant in children or adults, although the relative risks were all in favour of a reduction.

**Antenatal corticosteroids versus placebo or no treatment (analyses by gestational age at therapy)**

Subgroup analyses were performed for six gestational age categories according to when corticosteroid therapy was initiated: < 26, 26 to < 30, 30 to < 33, 33 to < 35, 35 to < 37, and > 36 weeks. However, each of these analyses was based on one to three trials, and the number of participants per subgroup was generally small. Across the six subgroups, the number of participants was lowest in the < 26 and > 36 weeks gestational age categories for the critical outcomes reported (with < 50 women in each category).

**Maternal outcomes**

**Maternal infectious morbidity:** Chorioamnionitis was significantly reduced in the women given corticosteroids between 30 and < 33 weeks of gestation (RR 0.19, 95% CI 0.04–0.86; 1 study, 294 women), but not in other gestational age categories.

**Fetal and neonatal outcomes**

**Fetal and neonatal death:** Compared to controls, a reduction in neonatal deaths for those infants whose mothers had been treated with corticosteroids between 26 and < 30 weeks of gestation was observed (RR 0.67, 95% CI 0.45–0.99; 1 study, 227 infants), while there were no significant differences in all other gestational age categories. No statistically significant differences were observed between groups for combined fetal and neonatal deaths or fetal deaths alone in the subgroups of gestational age at which corticosteroid was administered.

**Severe neonatal morbidity:** The frequency of RDS among infants of women receiving treatment between 26 and 34+6 weeks of gestation was reduced by approximately 50% (26 to < 30 weeks: 2 studies, 242 women, RR 0.49, 95% CI 0.34–0.72; 30 to < 33 weeks: 2 studies, 361 women, RR 0.56, 95% CI 0.36–0.87; 33 to < 35 weeks: 2 studies, 434 women, RR 0.53, 95% CI 0.31–0.91). There were no observed significant differences across other gestational age groups. Only those infants whose mothers were treated with corticosteroids between 26 and 29+6 weeks of gestation showed a significant reduction in the incidence of cerebroventricular haemorrhage (RR 0.45, 95% CI 0.21–0.95; 229 infants), while there were no significant differences across all other gestational age subgroups. Birth weight: Birth weight was significantly reduced for those infants whose mothers received treatment from 30 to < 33 weeks of gestation (MD -190.64 g, 95% CI -359.98 to -21.3). No differences in birth weight were observed in other gestational age subgroups.

**Antenatal corticosteroids versus placebo or no treatment (analyses by gestational age at birth)**

Subgroup analyses were also performed according to five categories of gestational age at birth of the preterm infant exposed to antenatal corticosteroid: < 28, < 30, < 32, < 34 and < 36 weeks.

**Maternal outcomes**

**Maternal infectious morbidity:** No difference was observed in the rate of chorioamnionitis between those treated with corticosteroid and those give placebo or no treatment across any of the gestational age
Fetal and neonatal outcomes

Fetal and neonatal death: There was a significant reduction in combined fetal and neonatal deaths among corticosteroid-exposed infants that were born before 32 weeks of gestation (RR 0.71, 95% CI 0.57–0.88; 3 studies, 453 infants), before 34 weeks (RR 0.73, 95% CI 0.58–0.91; 1 study, 598 infants) and before 36 weeks (RR 0.75, 95% CI 0.61–0.94; 2 studies, 969 infants). Neonatal deaths alone were significantly reduced in the corticosteroid-exposed infants that were born before 32 weeks (RR 0.59, 95% CI 0.43–0.80; 3 studies, 378 infants), before 34 weeks (RR 0.69, 95% CI 0.52–0.92; 2 studies, 715 infants) and before 36 weeks (RR 0.68, 95% CI 0.50–0.92; 2 studies, 869 infants). However, the significant reduction in both fetal and neonatal deaths, and in neonatal deaths alone was not observed for babies exposed to antenatal corticosteroids who were born before 28 weeks (fetal and neonatal death: RR 0.81, 95% CI 0.65–1.01, 2 studies, 129 infants; neonatal death: RR 0.79, 95% CI 0.56–1.12, 2 studies, 89 infants) nor those born before 30 weeks (fetal and neonatal death: RR 0.86, 95% CI 0.70–1.05, 1 study, 201 infants; neonatal death: RR 0.82, 95% CI 0.60–1.11, 1 study, 150 infants). Likewise, mortality was not reduced for infants born after 34 weeks of gestation (fetal and neonatal death: RR 1.13, 95% CI 0.66–1.96, 1 study, 770 infants; neonatal death: RR 1.58, 95% CI 0.71–3.50, 2 studies, 808 infants). For infants born at 36 weeks of gestation or over, there was a non-significant trend towards an increase in combined fetal and neonatal deaths (RR 3.25, 95% CI 0.99–10.66; 2 studies, 498 infants) associated with corticosteroid treatment, as well as in neonatal deaths alone (RR 2.62, 95% CI 0.77–8.96; 3 studies, 514 infants).

Severe neonatal morbidity: RDS was significantly reduced in infants of mothers treated with corticosteroids that were born before 30 weeks of gestation (RR 0.67, 95% CI 0.52–0.87; 4 studies, 218 infants), before 32 weeks (RR 0.56, 95% CI 0.45–0.71; 6 studies, 583 infants), before 34 weeks (RR 0.58, 95% CI 0.47–0.72; 5 studies, 1177 infants) and before 36 weeks (RR 0.52, 95% CI 0.40–0.69; 4 studies, 1022 infants). Antenatal corticosteroids were not shown to reduce RDS when analysed for all infants born after 34 weeks of gestation (RR 0.66, 95% CI 0.38–1.16; 5 studies, 1261 infants), after 36 weeks (RR 0.30, 95% CI 0.03–2.67; 5 studies, 557 infants) or before 28 weeks (RR 0.79, 95% CI 0.53–1.18; 4 studies, 102 infants). Cerebroventricular haemorrhage was significantly reduced in corticosteroid-exposed infants born before 28 weeks of gestation (RR 0.34, 95% CI 0.14–0.86; 1 study, 62 infants), before 32 weeks (RR 0.52, 95% CI 0.28–0.99; 1 study, 277 infants) and before 34 weeks (RR 0.53, 95% CI 0.29–0.95; 1 study, 515 infants). However, this benefit was not observed in infants born before 30 weeks (RR 0.56, 95% CI 0.29–1.01; 1 study, 150 infants), before 36 weeks (RR 0.56, 95% CI 0.31–1.02; 1 study, 767 infants), at a gestation of at least 34 weeks (RR 1.13, 95% CI 0.07–17.92; 1 study, 746 infants) or at a gestation of at least 36 weeks (no events reported in 459 infants). No statistically significant differences between the groups treated with antenatal corticosteroids and controls were seen for birth weight in the different subgroups of gestational age at birth that were examined.

Fetal and neonatal death: Hospital deaths were significantly lower in corticosteroid-exposed infants who were born at 23 weeks of gestation (adjusted OR 0.49, 95% CI 0.39–0.61), 24 weeks (adjusted OR 0.64, 95% CI 0.54–0.76) and 25 weeks (adjusted OR 0.57, 95% CI 0.48–0.69), but not those born at 22 weeks (adjusted OR 0.61, 95% CI 0.34–1.07), which may be due to the smaller sample size included in this group.

Long-term morbidity: After 18–22 months follow-up, intact survival in the entire cohort was 36%. However, intact survival was higher in infants whose mothers received corticosteroids compared to controls (35.8% versus 18.5%, adjusted OR 1.66, 95% CI 1.46–1.90). Death or neurodevelopmental impairment was also significantly less frequent in preterm babies born at 23–25 weeks of gestation, but not in those born at 22 weeks.

Antenatal corticosteroids versus placebo or no treatment (gestational age at birth from 22 to 25 weeks)
A separate review was conducted for infants with gestational age at birth of 22–25 weeks. This review found a prospective multicentre cohort study of 10 541 infants born at 22–25 weeks in the USA, which investigated the effect of exposure to antenatal corticosteroid on death or childhood neurodevelopmental impairment (15).

**Infant outcomes**

*Fetal and neonatal death:* Hospital deaths were significantly lower in corticosteroid-exposed infants who were born at 23 weeks of gestation (adjusted OR 0.49, 95% CI 0.39–0.61), 24 weeks (adjusted OR 0.64, 95% CI 0.54–0.76) and 25 weeks (adjusted OR 95% CI 0.57 0.48–0.69), but not those born at 22 weeks (adjusted OR 0.61, 95% CI 0.34–1.07), which may be due to the smaller sample size included in this group.

*Long-term morbidity:* After 18–22 months follow-up, intact survival in the entire cohort was 36%. However, intact survival was higher in infants whose mothers received corticosteroids compared to controls (35.8% versus 18.5%, adjusted OR 1.66, 95% CI 1.46–1.90). Death or neurodevelopmental impairment was also significantly less frequent in preterm babies born at 23–25 weeks of gestation, but not in those born at 22 weeks.

**Antenatal corticosteroids scale-up versus usual care (context of care)**

Evidence relating to the preconditions for administration of antenatal corticosteroid was informed by the findings of a large multicountry population-based cluster-randomized trial – the Antenatal Corticosteroids Trial (ACT).

This trial assessed the feasibility, effectiveness and safety of a multifaceted intervention designed to increase the use of antenatal corticosteroids at all levels of care (primary health centres and non-hospital facilities, community health clinics, dispensaries and hospitals) (14). The study was conducted in 102 distinct geographical rural and semi-urban clusters in low-resource countries (Argentina, Guatemala, India, Kenya, Pakistan and Zambia) with birth records of close to 100 000 women. The intervention involved health-care provider training to assess gestational age and to identify women at high risk of preterm birth (presenting between 24 and 36 weeks of gestation with signs of labour, PPROM, pre-eclampsia or eclampsia, or antenatal haemorrhage). Health-care providers in this context included all birth attendants working in the intervention clusters, including physicians, nurses, community health workers and traditional birth attendants (TBAs) providing delivery care at hospitals, clinics, in the community or in home birth settings, respectively. Gestational age was determined by the use of an algorithm that included last menstrual period (LMP) and estimated date of delivery (EDD), or uterine height if neither LMP nor EDD were known. Where LMP or EDD was known, gestational age was assessed using a specially designed obstetric disk. When reliable information on gestational age was not available, uterine fundal height was used as a proxy for gestational age and was measured using a validated colour-coded tape 17 with a red zone indicating estimated gestational age less than 36+0 weeks. For every woman identified to be at high risk of preterm birth, health-care providers received training to administer a single course of four doses of 6 mg of dexamethasone at intervals of 12 hours. The control sites received no intervention apart from training in essential newborn care as in the intervention clusters.

**Identification of women at risk of preterm birth and use of corticosteroids**

A total of 6214 (13%) of 48 219 women in the intervention cluster were identified as being at high risk of preterm birth. Of these women, 87% were identified at the community and primary health care levels, 77% were identified based on signs of preterm labour, 50% were identified at 33–36 weeks of gestation, and 98% received antenatal corticosteroids (out of which 83% received the first dose at the community and primary health care levels). Only 16% of all women who received antenatal corticosteroids in the intervention clusters gave birth to a < 5th-percentilebirth-weight infant (a proxy for preterm infant). The intervention
strategy increased coverage of antenatal corticosteroids in the intervention compared with the control clusters. Compared with 10% in control clusters, 45% of < 5th-percentile-birth-weight infants in the intervention clusters were exposed to at least one dose of corticosteroid. In the intervention clusters, delivery care for < 5th-percentile-birthweight infants was provided by physicians, nurses, TBAs and family members in 44%, 32%, 20% and 5% of cases, respectively; and the location of birth was in the hospital, clinic, and home or other birth setting in 51%, 26% and 23% of cases, respectively.

Maternal outcomes

Maternal infectious morbidity: “Suspected maternal infection” (a composite variable defined as antibiotic use plus hospital admission or referral, and use of intravenous fluids, surgery or other treatment related to infection, and evidence of antepartum or postpartum infection among mothers of infants with birth weight < 2500 g) was used to assess maternal safety in relation to corticosteroid use. Among women who delivered < 5th-percentile-birth-weight infants, there was a significantly increased risk of suspected maternal infection in intervention clusters as compared with control clusters (10% versus 6%; OR 1.67, 95% CI 1.33–2.09). Likewise, suspected maternal infection was significantly higher among all women in the intervention clusters compared with control clusters (3% versus 2%; OR 1.45, 95% CI 1.33–1.58; 99,737 women).

Infant outcomes

Neonatal death: Neonatal mortality among < 5th percentile-birth-weight infants was not significantly different between intervention and control clusters (RR 0.96, 95% CI 0.87–1.06; 4,778 infants), and neither were stillbirths (RR 0.99, 95% CI 0.90–1.09; 6,262 infants) or perinatal deaths (RR 0.97, 95% CI 0.91–1.04; 6,265 infants). However, there was a 12% increase in neonatal mortality among all live-born infants (regardless of birth weight) in the intervention clusters as compared with the control clusters (RR 1.12, 95% CI 1.02–1.22; 98,137 infants). Likewise, there was an 11% increase in the rate of stillbirth (RR 1.11, 95% CI 1.02–1.22; 100,705 infants) and perinatal death (RR 1.11, 95% CI 1.04–1.19; 100,705 infants) in the intervention clusters compared with control clusters.

Further information and considerations related to this recommendation can be found in the WHO guidelines, available at:

http://apps.who.int/iris/bitstream/handle/10665/183037/9789241508988_eng.pdf?sequence=1

http://apps.who.int/iris/bitstream/handle/10665/183038/WHO_RHR_15.17_eng.pdf?sequence=1

Implementation considerations

- The successful introduction of this recommendation into national programmes and health-care services depends on well-planned and participatory consensus-driven processes of adaptation and implementation. The adaptation and implementation processes may include the development or revision of existing national guidelines or protocols based on this recommendation.
- The recommendation should be adapted into a locally appropriate document that can meet the specific needs of each country and health service. Any changes should be made in an explicit and transparent manner.
- A set of interventions should be established to ensure that an enabling environment is created for the use of the recommendations, and that the behaviour of the healthcare practitioner changes towards the use of this evidence-based practice.
- In this process, the role of local professional societies is important and an all-inclusive and participatory process should be encouraged.
Research implications

The GDG identified these priority questions related to this recommendation:

- What are the long-term outcomes of all infants exposed to antenatal corticosteroids (including term infants)?
- What strategies can effectively and safely increase the use of corticosteroids in low- and middle-income country (LMIC) settings to improve outcomes?
- What are the effects of antenatal corticosteroid at different gestational ages at birth (using independent patient data analysis)?
- Assessment of coverage of antenatal corticosteroids before and after guideline implementation (and associated reduction in neonatal mortality).
- Assessment of implementation strategies and monitoring of adverse events (in LMIC settings).
- What are the effects of task shifting in the context of antenatal corticosteroid administration (e.g. using the first dose in the community followed by referral to a health-care facility)?
- Are there differences in the pharmacokinetic properties of betamethasone acetate versus betamethasone phosphate (consider using available data in settings where they are routinely used)?
- What is the impact of antenatal corticosteroid administration among mothers with evidence of infection who also receive appropriate antibiotic therapy on both maternal and neonatal outcomes?
- What is the minimum effective dose of corticosteroids to achieve fetal lung maturation and other improved outcomes?
- What is the minimum effective dose required for repeat courses of antenatal corticosteroids?
- What is the most effective regimen and dose for antenatal corticosteroids?
- In what contexts can antenatal corticosteroids be used safely and effectively in low-income countries?

Related links


Managing Complications in Pregnancy and Childbirth: A guide for midwives and doctors

Pregnancy, Childbirth, Postpartum and Newborn Care: A guide for essential practice

WHO Programmes: Sexual and Reproductive health

Maternal Health

Infant, Newborn Health

Supporting systematic review:


References

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