International Journal of Contemporary Pediatrics
Shivtej N et al. Int J Contemp Pediatr. 2019 Jan;6(1):82-86
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20185152

Original Research Article

Effect of single dose and double dose antenatal corticosteroids on respiratory distress syndrome among preterm babies

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Received: 04 December 2018
Accepted: 15 December 2018

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ABSTRACT

Background: Respiratory distress syndrome occurs primarily in premature infants. The increased risk of RDS is associated with lower gestational age. The length of gestation is the primary factor that influences the risk of RDS the risk for development of RDS increases with maternal diabetes, multiple births, cesarean delivery, precipitous delivery, asphyxia, cold stress, and a maternal history of previously affected infants. Antenatal corticosteroids (ACS) significantly reduced neonatal morbidity and mortality when administered to women with imminent preterm delivery Antenatal steroids accelerate development of type 1 and type 2 pneumocytes, leading to structural and biochemical changes that improve both lung mechanics (maximal lung volume, compliance) and gas exchange. Induction of type 2 pneumocytes increases surfactant production by inducing production of surfactant proteins and enzymes necessary for phospholipid synthesis. Alveolisation occurs rapidly as a result of the antenatal corticosteroids Antenatal corticosteroid is usually administered for fetal lung maturity and can be expected to induce negative maternal and fetal side-effects hence this study was conducted to know the beneficial effect of single dose antenatal corticosteroids verses double doses antenatal corticosteroids. The Objective of the present study was to observe the effect of single dose and double dose antenatal corticosteroids on respiratory distress syndrome in preterm babies born to mothers less than 37 weeks of gestation admitted under department of pediatrics at Raja Rajeswari medical college Hospital, Kambipura, Bangalore.
Methods: There were 55 babies born to mothers who received single dose of antenatal corticosteroids and delivered at 12hrs before receiving 2nd dose antenatal corticosteroids and 55 babies born to mothers who received double dose of antenatal corticosteroids. Once baby is born, they compared for the requirement of surfactant.
Results: Multiple course of steroids significantly reduced Respiratory distress syndrome.
Conclusions: It was concluded that there was significant reduction in RDS in babies whose mother received complete course of antenatal corticosteroids.

Keywords: Antenatal corticosteroids (ACS), Neonatal morbidity, Respiratory distress syndrome (RDS)

INTRODUCTION

Preterm forms 10% of all births and one million babies die each year as a direct consequence of being born preterm.[1] the rate of preterm birth ranges from 5 to 18% of babies born across 184 countries, according to WHO. According to Indian foundation for premature babies the rate of premature births in India is presently around 21% of babies. Preterm birth can have significant effects on short-term morbidity and mortality, and also long-term health and disability. The short-term sequelae of preterm birth include respiratory distress syndrome (RDS), necrotising enterocolitis (NEC), intraventricular

hemorrhage (IVH) and sepsis.[2] The most common causes of death during the first 6 days of life were respiratory distress syndrome (65%) and immaturity (51%) and during the following 3 weeks, the reported leading causes of death were necrotizing enterocolitis (NEC, 44%), RDS (22%), and severe intraventricular hemorrhage (IVH, grade 3-4, 17%).[3] Corticosteroid treatment given to pregnant women is the only antenatal therapy with significant efficacy in the prevention of RDS and IVH. Preterm infants benefit from antenatal corticosteroid treatment administered more than 24 hours and less than 7 days before delivery.[4] The use of antenatal corticosteroids, intubation in the delivery room, and surfactant treatment reduce mortality during the first 12 hours.[5,6] Respiratory distress syndrome (RDS) is defined as a need for continuous distending airway pressure and supplemental oxygen for at least 48 hours and typical chest X-ray findings or a need for surfactant therapy in cases of established respiratory failure.

RDS has been the most important cause of morbidity and mortality in premature infants. RDS is still the most frequent acute pulmonary disease among ELBW infants during the neonatal period.[3,7]

Multiple courses of antenatal corticosteroids are associated with early severe lung disease in preterm neonates.[8] Several studies have suggested an adverse effect on fetal neurological development. Administration of both multiple and single courses of corticosteroids have been shown to cause growth retardation.[9]

METHODS

This prospective study was undertaken at Raja Rajeswari Medical College and Hospital after obtaining Institutional ethical committee approval. All babies born from January 2017 to June 2018 were included in the study with gestational age less than 37 weeks. A detailed history was taken including maternal history, gestational age, medical history, date, time and number of corticosteroids taken by mother antenatally were included and all babies who were born to mothers who received 1 dose betamethasone and delivered before receiving 2nd dose of steroids were compared to babies who were born to mothers who received 2 doses off betamethasone were included. Mother details are noted in detail and once baby was delivered detail examination including Ballard score, systemic examination done, respiratory distress score given using Anderson Silvermanscore , chest X-ray was done and need of surfactant was noted.

Inclusion criteria

- All babies born to mother with gestational age less than 37 weeks who received 2 doses of antenatal corticosteroids 12mg of betamethasone 12hrs apart.
- All babies born to mother with gestational age less than 37 weeks who received 1doses of antenatal corticosteroids 12mg of betamethasone and deliver after 12hrs before receiving second dose.

Exclusion criteria

- All mothers who received steroids for medical illness
- Cushing's disease.

Once the baby is born is admitted in NICU and babies were included in study based on inclusion and exclusion criteria, baby was examined and gestational age was estimated using ballard score, the need for surfactant was noted and compared with the babies born to mother who received single dose of antenatal corticosteroids to babies who were born to mother who received double dose of antenatlcorticosteroids.

Statistical analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data. Continuous data was represented as mean and SD. Independent t test or Mann Whitney U test was used as test of significance to identify the mean difference between two quantitative variables and qualitative variables respectively.

RESULTS

Among subjects in Single dose group, 41.8% were female and 58.2% were males and among double dose subjects 54.5% were females and 45.5% were males. There was no significant difference in sex distribution between two groups (Table 1).

Table 1: Sex distribution comparison between single and double dose group.

		Group					
		Single dose		Double dose		Total	
		Count	%	Count	%	Count	%
Sex	Female	23	41.8	30	54.5	53	48.2
	Male	32	58.2	25	45.5	57	51.8

$\chi 2 = 1.784$, df = 1, p = 0.182

Table 2: RDS comparison between two groups.

		Group					
		Single dose		Double dose		Total	
		Count	%	Count	%	Count	%
RDS	No	42	76.4	50	90.9	92	83.6
	Yes	13	23.6	5	9.1	18	16.4

$\chi 2 = 4.251$, df = 1, p = 0.039*

In Single dose group, 23.6% had RDS and in Double dose group 9.1% had RDS.

This difference in RDS between two groups was statistically significant suggesting that incidence of RDS is less in babies born to mothers who received double dose antenatal corticosteroids (Table 2).

In the study there was no significant association between Complications and Gestational age in single dose group (Table 3).

Table 3: Association between gestational age and complications in single dose group.

		Gestational age				P value
		28+1 to 34 weeks		34+1 to 37 weeks		
		Count	%	Count	%	
RDS	No	18	66.7	24	85.7	0.096
	Yes	9	33.3	4	14.3	

Table 4: Association between gender and complications in single dose group.

		Sex				P value
		Female		Male		
		Count	%	Count	%	
RDS	No	17	73.9	25	78.1	0.717
	Yes	6	26.1	7	21.9	

In the study there was no significant association between Complications and Gender in Single dose group (Table 4). In the study there was no significant association between Complications and Gestational age in Double dose group (Table 5). Mean birth weight in Single dose group was 1.8±0.6kg and in Double dose group was 1.8±0.5kg. There was no significant association between gender and complication in double dose group (Table 6).

Table 5: Association between gestational age and complications in double dose group.

		Gestational age				P value
		28+1 to 34 Weeks		34+1 to 37 weeks		
		Count	%	Count	%	
RDS	No	28	84.8	22	100.0	0.056
	Yes	5	15.2	0	0.0	

Table 6: Association between gender and complications in double dose group.

		Sex				P value
		Female		Male		
		Count	%	Count	%	
RDS	No	27	90.0	23	92.0	0.797
	Yes	3	10.0	2	8.0	

DISCUSSION

In present study, babies born to mothers who received double dose of antenatal corticosteroids only 5(9.1%) had RDS compared to babies born to mothers who received single dose of antenatal corticosteroids were 13(23.6%) babies had RDS. This is a retrospective cohort study by Kim et al in which 147 infants delivered by 116 women at 21-23 weeks of gestation between January 2001 and December 2016 at a tertiary referral hospital in Seoul, Korea. Eligible subjects were categorized into the following three groups according to ACS exposure: non-user (n = 53), partial-course (n = 44), and complete-course (n = 50) Neonatal mortality rate was significantly lower in the ACS-user groups (non-user, 52.8%; partial-course, 27.3%; complete-course, 28.0%; P = 0.01), but complete-course of ACS therapy had no advantages over partial.[10]

Women 23 to 32 weeks receiving 1 course of corticosteroids 7 to 10 days prior were randomized to weekly betamethasone or placebo. The study was terminated by the independent data and safety monitoring committee with 495 of the anticipated 2400 patients enrolled. There was no significant reduction in the composite primary morbidity outcome (8.0% vs 9.1%, P=.67). Repeated courses significantly reduced neonatal surfactant administration (P=.02), mechanical ventilation (P=.004), CPAP (P=.05), Repeat antenatal corticosteroids significantly reduce specific neonatal morbidities but do not improve composite neonatal outcome.[11]

In McEvoy C et al, Pregnant women 25 to 33 weeks' gestation, who remained undelivered 1 week after their first course of antenatal corticosteroids (two 12-mg doses of betamethasone) were randomized to weekly courses of corticosteroids versus weekly placebo until delivery or 34 weeks' gestation. FRC was measured Thirty-seven infants were studied, infant demographics were similar. There was no significant difference between the infants who received a single remote course of antenatal corticosteroids and those who received weekly courses of corticosteroids until delivery.[12]

In Peltoniemi OM et al, A total of 249 mothers have been enrolled. All of the 159 infants in the betamethasone group and 167 in the placebo group were born before 36 weeks of gestation. The requirement for surfactant therapy in respiratory distress syndrome was increased in the betamethasone group. According to posthoc analysis of the data for 206 infants who were delivered within 1 to 24 hours, the betamethasone booster tended to increase the risk of respiratory distress syndrome and to decrease intact survival rates.[13] Gaur et al studies total 111 newborns for neonatal parameters, 71 of whom were born within 24 hours of betamethasone administration. Seventy-one newborns delivered within 24 hours of betamethasone administration and rest 40 delivered after 24 hours. Out of these 71, 51(71.8%) deliveries were preterm. RDS at birth was recorded in only 14 neonates out of whom, 12 were born within 24 hours of betamethasone administration concluding that There was some beneficial effect in babies born after 24 hours of betamethasone administration.[14]

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Shivtej N, Prema R, Naidu A, Amrutha BS, Mehta VB. Effect of single dose and double dose antenatal corticosteroids on respiratory distress syndrome among preterm babies. Int J Contemp Pediatr 2019;6:82-6.