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Clinical Study of Respiratory Distress Syndrome in Al-Kadhimiya Teaching Hospital

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Abstract

Background Respiratory distress syndrome (RDS) or hyaline membrane disease (HMD) is an acute lung disease of the newborn caused by surfactant deficiency. It is Seen primarily in neonates younger than 36-38 weeks of gestational age weighing less than 2500 gram.

Objective To find out the incidence, main risk factors of HMD, note the changes in serum calcium, potassium and sodium and to study the outcome of HMD during the period of the illness.

Methods A prospective study was performed on one hundred neonate admitted to the neonatal care unit in Al-Kadhimiya Teaching Hospital. Sex, gestational age, weight, mode of delivery, maternal illnesses were studied as risk factors. Serum calcium, Na and K were measured.

Results The incidence of RDS was 0.75% of total live births, 98(98%) of them were below 2.499 kilograms and less than 37 weeks of gestational age. Risk factors of RDS are male sex accounted for 61% of total cases. Cesarean sections were 28% of the total. Maternal diabetes mellitus represented 25%. Perinatal asphyxia was 22%. Familial predisposition had an incidence of 8% and finally prolonged rupture of membranes stood for 5%. Hypocalcaemia and hypokalemia were common with serum sodium was within the lower normal limits. The time of improvement for most babies (about 40%) was by day 4 of life. Mortality was 30% with the major percentage of death (which was 90%) was between day 1 and day 4.

Conclusion RDS occurs predominantly in premature babies as a main risk factor with male sex and cesarean sections. In addition to other risk factors such as maternal diabetes mellitus and perinatal asphyxia. Associated changes in serum electrolytes and serum calcium including hypocalcaemia, hypokalemia and lower normal serum sodium are common. The 4th day of life was the time of improvement for most babies while most of them who died did so by the first 4 days of life. Among the admitted babies, about third of them (actually 30%) died because of RDS.

Key words RDS, Gestational age, Mortality.

Introduction

Respiratory distress syndrome (RDS), also known as hyaline membranedisease (HMD), is an acute lung disease of the newborn caused by surfactant deficiency (Surfactant is synthesized in type II pneumocytes or alveolar cells, It appears in the amniotic fluid between 28-32 weeks, but mature levels of pulmonary surfactant are usually present after 35 weeks' gestational age).

It is seen primarily in neonates younger that 36-38 weeks' gestational age and weighing less than 2500 gm [(1-4)].

The infant is often with one or more of the following risk factors, prematurity, male sex, familial predisposition, cesarean section, perinatal asphyxia, chorioamnionitis, hydrops, and maternal diabetes [(3,5)].

Most of the affected infants exhibit progressive signs of respiratory distress soon after birth that

include tachyapnea, expiratory grunting (from partial closure of glottis), subcostal and intercostals retractions, cyanosis and nasal flaring [1,2,5-7].

The natural course of the disease is that of increasing severity duringthe first 1-2 days before improvement occur during 4th or 5th day, which is heralded by spontaneous diuretic phase of RDS [8].

Radiological findings are correlated with the severity of clinical findings, as they are normal in the early period of the disease. Blood gas sampling can be obtained (mixed respiratory and metabolic acidosis, hypoxemia) [3,5]. Pulse oximetry is used as a non-invasive tool to monitor oxygen saturation, which should be maintained at 88-95% [1,3]. Serum electrolyte levels and calcium should be monitored every 12-24 hours for management of parenteral fluids [3]. Serum glucose level may be high or low initially and must be monitored closely to assess the adequacy of dextrose infusion. Hypoglycemia alone can lead to tachypnea and respiratory distress [3].

Administration of betamethasone to the women 48 hours before the delivery of the fetuses between 24-34 weeks of gestational age significantly reduces the incidence of RDS [1-3,5]. Repeated weakly doses of betamethasone until 32 weeks may reduceneonatal morbidity and duration of mechanical ventilation. By the usage of surfactant replacement therapy, the mortality rate of RDS decreases by about 50% [3,5,9].

Early supportive care of low birth weight (LBW) infants, Surfactant replacement, Oxygenation and continuous positive airway pressure (CPAP), Assisted ventilation, Antibiotic therapy [2,3,5,6]. The intensive observation and care of high-risk newborn infants can significantly reduce the morbidity and mortality of RDS [1].

Antenatal steroids, postnatal surfactant use, improved modes of ventilation, and developmentally appropriate care have resulted in low mortality from RDS (≈10%) [4]. Mortality increases with decreasing gestational age. Surfactant therapy reduces mortality about 40%. About 85-90% of all infants surviving RDS are normal. Infants weighing more than 1500g have much better outcomes.

The long term prognosis for normal pulmonary function is excellent [1,4,10].

The intension of the study is to find out the incidence, main risk factors of HMD, note the changes in serum calcium, potassium and sodium, and to study the outcome of HMD during the period of the illness in the neonatal care unit in Al- Kadhimiya Teaching Hospital.

Methods

A prospective study was performed and one hundred babies admitted to the neonatal care unit in Al-Kadhimiya Teaching Hospital out of 13258 live births to mothers admitted to the obstetrics and gynecology department during a period from the first of July 2007 to the first of January 2008. The clinical diagnosis of RDS was based upon the following:-

1. Tachyapnea (respiratory rate>60/minute).
2. Expiratory grunting.
3. Sternal and intercostal recession.
4. Cyanosis in room air.
5. Delayed onset of respiration in very immature babies.
6. The radiological findings which include fine granular, ground glass appearance, and air bronchogram.

The following information was collected from obstetricians, mothers and relatives of the newborn; including type of delivery, prolonged rupture of membranes and maternal DM and family history of similar condition.

Then, full systematic examination was done to all admitted neonates and during their stay in neonatal care unit; they were followed carefully with special concern about their treatments, complications and their outcomes.

Portable chest X-ray, serum potassium, sodium and calcium were done to all of them immediately after admission. We assumed that the normal values as follow:

Serum sodium is 132-145 mmol/l, serum potassium is 4-7 mmol/l and serum calcium is 7.2-11.2 mg/dl [4,5]. Blood culture and other investigations were done according to specific

conditions and complications occurred. Neonates with transient tachyapnea of the newborn (TTN) and meconium aspiration, pneumonia were excluded from this study. The weight of the neonates was measured by scale, and gestational age assessed by expanded New Ballard Score.

Neonates were divided into six groups according to their birth weights and gestational ages as follows; (a) ≤ 0.999 kg and/or (≤ 28 wk), (b) 1-1.499 kg and/or (29-30 wk), (c) 1.500-1.699 kg and/or (31-32 wk), (d) 1.700-1.999 kg and/or (33-34 wk), (e) 2-2.499 kg and/or (35-36 wk), (f) ≥ 2.500 kg and/or (≥ 37 wk).

Results

The number of live births during the period of the study in Al-Kadhimiya Teaching Hospital was (13258) and (100) out of (4782) admitted to the neonatal unit were suffering from RDS which equals to a percentage of (0.75%).

The highest incidence of RDS was in those who were 29-30 week of gestational age (35%) and mainly in male sex (22 out of 35) with the highest male: female ratio in those who were ≤ 28 week of gestational age which was (1.8:1); while there is equal ratio for those with ≥ 37 week of gestational age; these are shown in table 1.

Table 1. Sex distribution of the patients with gestational age

Gestational age (weeks)	♂	♀	Total No.	%	M:F
≤28	11	6	17	17	1.8:1
29-30	22	13	35	35	1.7:1
31-32	13	9	22	22	1.4:1
33-34	9	7	16	16	1.3:1
35-36	5	3	8	8	1.6:1
≥37	1	1	2	2	1:1
Total	61	39	100	100	1.5:1

There are various risk factors for RDS with different percentages, relationships and frequencies of occurrence. Preterm neonates were with the highest percentage which was 98(98%) while the second most frequent risk factor was male sex 61(61%), cesarean section had a high rate 28(28%) diabetic mothers had a risk to develop RDS in their newborn babies with a percentage of 25(25%), after that; the perinatal asphyxia comes with 22 cases (22%), finally; the other less important risk factors were familial predisposition 8 cases (8%) and prolonged rupture of membranes with chorioamnionitis 5 cases (5%). All the above risk factors are shown in table 2.

Table 2. Various risk factors for RDS and their percentage

Risk factor	%
Preterm	98
Male	61
Cesarean section	28
Maternal DM	25
Perinatal asphysxia	22
Familial predisposition	8
Prolonged rupture of membranes	5

Serum sodium values were in the normal range but actually most of the patients were on the lower limits of the range, while serum potassium values were swinging between the normal range and above it with the fact that most of patients were on the highest readings.

On the contrary, serum calcium values were swinging from below the normal range to the normal with the most of patients was on the lowest readings. These are best illustrated in table 3.

Table 3. Serum sodium, calcium, and potassium in relation to gestational age

Gestational age (weeks)	Serum Na^+		Serum Ca^{2+}		Serum K^+	
	Mean value	Range	Mean value	Range	Mean value	Range
≤ 28	137.5	133-142	7.20	6.6-7.8	6.55	5.3-7.8
29-30	136.5	132-141	7.30	6.9-7.7	6.40	5.2-7.6
31-32	140.0	134-146	7.20	6.5-7.9	6.50	5.5-7.5
33-34	138.5	133-144	7.40	6.7-8.1	6.50	5.4-7.6
35-36	139.5	134-145	7.55	6.5-8.6	6.35	5.3-7.4
≥37	141.5	135-138	6.60	6.4-6.8	5.70	5.1-6.3

There is a specific relationship between the gestational age, body weight and time of improvement in days, as shown in table 4. The time of improvement fastens with increasing gestational age and most of the patients improved actually within the first 4 days within a range of 2-9 days.

Table 4. Time of improvement in days according to body weight

Gestational age (years)	Time of improvement (days)	Mean value
≤28	4-9	6.5
29-30	3-8	5.5
31-32	2-8	5.0
33-34	3-7	5.0
35-36	2-4	3.0
≥37	2-3	2.5

Another relationship is between the gestational age, body weight and time ofdeath in days, it also shows that the time of death in days is increased with increasing gestational age with a significant decline from the first to thefourth day within a range of 1-7 days. These are best shown by table 5.

About two thirds of the patients 70 (70%) survived and discharged home, whilethe other third had died with a percentage of 30 (30%).

Discussion

The incidence of RDS in Al-Kadhimiya Teaching Hospital during the period of the study was 0.75% among all live birth deliveries. Al-Saraj (in Al-Mosul) reported the same incidence of 0.75% in his study [11], while Al-Ezzi (in Al-Ramadi) reported 0.72% [12]. In US the incidence was about 1% [13], about 0.6% of newborns had RDS (about 24,000 or 6 per 1,000 live births) [14] and finally, Peter (in United States) gave an incidence of 1% [2].

The gestational ages of 98% of the babies were ≤ 36 weeks while it was 97% in Al-Saraj study (11) and most cases are seen in babies born before 28 weeks. It is very uncommon in infants born full-term (at 40 weeks) [15], with the highest incidence was in those who were 29-30 weeks of gestational age, although it was 31-32 weeks of gestational age as Al-Saraj found [11].

Table 5. Time of death according to body weight

Gestational age (years)	Time of death (days)	Mean value
≤28	1-5	3.0
29-30	1-6	3.5
31-32	1-7	4.0
33-34	1-7	4.0
35-36	2-5	3.5
≥37	----	---

Regarding the sex of the babies with RDS, 61% of the babies were males and 39% were females, while Al-Saraj claimed that 58% were males and 42% were females [11]. Al-Ezzi found that 60% were males and 40% were females [12]. Scope reported males' incidence as 59% and females' as 41% [14]. Other risk factors include multifetal pregnancies, maternal diabetes, and being male

and white [16]. Cesarean section as a risk factor was present in 28% as compared to 15% reported by Al-Saraj [11] and 20% of Al-Ezzi [12]. Maternal DM 25% and they are full term as compared with 31% claimed by Al-Saraj [11]. Perinatal asphyxia in 22% with a near percentage reported by Al-Saraj which was 20% [11]. Familial predisposition in 8% which is almost similar to that reported by Al-Saraj with his 8.5% [11] and Stoll and Kliegman (in United States) who claimed an increase in incidence of RDS with a familial predisposition [1]. Prolonged rupture of membranes was 5%, which is in consistent to that reported by Al-Saraj with 6% [11]. The risk of neonatal RDS may be decreased if the pregnant mother has chronic, pregnancy-related high blood pressure or prolonged rupture of membranes, because the stress of these situations can cause the infant's lungs to mature sooner [17], at the same time this is what Stoll and Kliegman had said [1].

Hypocalcaemia and hyperkalemia were common among neonates with RDSespecially those with more severe respiratory symptoms, infants of diabetic mothers, more premature and non-fed babies. While serum sodium was mostly within the lower normal results which may be due to inappropriate secretion of antidiuretic hormone (ADH) secondary to RDS. These findings are in consistent to that found by Peter [2] and Tricia et al (in United States) [3].

Forty percent of babies improved by day 4 with no more oxygen requirement after 4th day, and the average of improvement is between day 2 and day 9 the that is decreased with increasing gestational age. This is agreed by the study done by Al- Saraj with 42% improvement by day 4 and a range of 2-9 days [11], The condition often worsens for 2 to 4 days after birth with slow improvement thereafter [17] other study said that RDS resolves within 4 or 5 days [15].

The time of death in days declines exponentially from the 1st. day to the 4th day where 90% of deaths occur during this period with a range of 1-7 days. Some infants with severe respiratory distress syndrome will die, although this is rare on the first day of life. If it occurs, it usually happens between days 2 and 7 [17].

The mortality rate was 30% which lies within that reported by Al-Saraj being 35% [11] while it was 10% in other studies (in United States) [16] andThe overall mortality for newborns with documented RDS was 81/200 (41%), and was highest (70%) for babies weighing <1000g at birth [18] and Dinwiddie (in England) who said that mildly affected infants recover with no more than good nursing care, warmth, graduated oxygen therapy and minimal handling with an overall mortality of 10% [16] but a more pessimistic results were reported by Al-Ezzi of about 48% [12], in contrast to what had been claimed by Stoll and Kliegman as a 10% mortality rate [1].

By conclusion the incidence of RDS was 0.75% and the greatest incidence was in those who were 29-30 weeks of gestation, the main risk factors for RDS are prematurity, male sex and cesarean sections.

The mortality rate was 30% and most of patients die between day 1 and day 4. While the time of improvement for most babies is day 4.

Hypocalcemia and hyperkalemia were common while serum sodium within the lower normal limits. So we recommend improving the antenatal care of all pregnant and better selection of patients for cesarean sections. Nursing staff that works in neonatal unit should be well trained withperiodic educational courses. The nursery care units should be supplied with all facilities for mechanical ventilation and blood gas analysis with serum electrolytes and calcium should be available for early detection and follow up of complications. Availability of surfactant replacement is vital because it is effective for both prevention and treatment of RDS.

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