Libyan Journal of Science & Technology 8:1 (2018) 56–58

Faculty of Science - University of Benghazi

Libyan Journal of Science & Technology

journal home page: www.sc.uob.edu.ly/pages/page/77

Factors affecting the response of the premature neonates with respiratory distress syndrome to the surfactant therapy in Benghazi pediatric hospital

Isaaida A. Elsaiti [a], Lubna J. Abdulmalek [b*]

[a]*Department of Pediatrics, Faculty of Medicine, University of Benghazi, Benghazi, Libya*

[b]*Department of family &community medicine, Faculty of Medicine –University of Benghazi, Benghazi, Libya*

Highlights

- **Assess the response of the premature neonates with respiratory distress syndrome to the surfactant therapy.**
- **Study the factors affecting the response to the surfactant therapy.**

ARTICLE INFO

Article history:
Received 27 September 2018
Revised 13 December 2018
Accepted 20 December 2018
Available online 31 December 2018

Keywords:
Premature; neonates, respiratory distress; surfactant; response.

*Corresponding Author:

E-mail address: lubna.abdulmalek@uob.edu.ly
L J. Abdulmalek

ABSTRACT

BACKGROUND: Respiratory distress syndrome (RDS) is a common problem in premature babies who born before 37 weeks of gestation. It occurs due to the lack of pulmonary surfactant, which is a phospho-lipoprotein produced by alveolar cells at the last stage of lung development. There are many risk factors of RDS among premature neonates including; born before the 28th week of gestation and Low birth weight.

OBJECTIVES: To assess the response of the premature neonates admitted in Benghazi pediatric hospital with respiratory distress syndrome (RDS) to the surfactant therapy and factors affecting it.

METHODS: The records of all respiratory distress premature neonates who admitted to the hospital during the year 2013, received surfactant (Survanta) 4 ml/kg under a sterile condition through special endotracheal tube and kept on a ventilator either continuous positive airway pressure (CPAP) or intermittent positive pulmonary ventilation (IPPV)were reviewed.

RESULTS: The total number of cases with RDS and received surfactant therapy were 38 cases.63% of them were born before 34-week gestational age, 84% of the cases their birth weight were less than 2.0 kg. About 55% of the respiratory distress premature neonates respond to the surfactant therapy and cured. The most significant factors affected their response were gestational age, birth weight, complications during pregnancy and the type of assisted ventilator.

CONCLUSION: The response of premature neonates with RDS to the surfactant therapy can be improved by treating the pregnancy complications and using a continuous positive airway pressure ventilator.

© 2018 University of Benghazi. All rights reserved.

1. Introduction

Respiratory distress syndrome (RDS) is a common problem in premature babies who born before 37 weeks of gestation. It occurs due to a lack of pulmonary surfactant, which is a phospho-lipoprotein produced by alveolar cells at the last stage of lung development (Lawn *et al.*, 2014). There are many risk factors of RDS among premature neonates including; born before the 28th week of gestation and Low birth weight. The risk of developing RDS increase with maternal diabetes, multiple births, cesarean section delivery, cold stress, and a history of previously affected infants (Edwards *et al.*, 2013).

An estimated 2.9 million neonatal deaths occur each year worldwide, the majority of which happen in developing countries (Edwards *et al.*, 2013). RDS can be fatal especially over the first 2 to 3 days if not treated with extra oxygen, surfactant replacement, and medicines (Zaman *et al.*, 2013).

Respiratory distress syndrome was first discovered in 1959 by Avery and Mead as a surfactant deficiency disease of the neonate (Avery & Mead, 1959) while in 1980, was the first administration of an exogenous surfactant as a treatment of RDS by Fujiwara and his colleagues (Fujiwara *et al.*, 1980)

According to the results of previous clinical trials and epidemiological studies on the effect of the exogenous surfactant therapy, it was significantly improved the survival of premature neonates with respiratory distress syndrome and decreased the incidence and severity of the disease (Fedakar & Aydogdu, 2011) and (Reuter *et al.*, 2014). But it found that approximately 20% to 30% of neonates did not respond to surfactant administration disease (Swarnkar & Swarnkar, 2015; Kommawar *et al.*, 2017). The reasons for that are not clear until now. That is why this study was conducted to assess the response of the premature neonates admitted in Benghazi pediatric hospital with respiratory distress syndrome (RDS) to the surfactant therapy and factors affecting it.

Subjects and method

Study Period: from the 1st of January to the end of March 2014.

Study place: Benghazi pediatric hospital.

Study design: Retrospective observational case series study.

Study subjects: The records of all respiratory distress premature neonates who admitted to the hospital during the year 2013, received surfactant (Survanta) 4 ml/kg under a sterile condition through special endotracheal tube and kept on a ventilator either

Continuous positive airway pressure (CPAP) or Intermittent positive pulmonary ventilation (IPPV) were reviewed. (No Exclusion criteria) Study Tools and methods of data collection: Checklist was used to collect the data from the hospital records, the data was collected retrospectively. Information collected included gestational age, sex, weight, pregnancy complications (maternal diabetes, multiple births, and a history of previously affected infants), mode of delivery, Age of neonates when given surfactant therapy, complications, outcome, causes of death if happened and Type of the assisted ventilator.

2. Statistical Analysis

Data were entered and analyzed using SPSS statistical program (version 23), for calculating the number, the percentage and chi-square test, using the level of significance at P<0.05 and P< 0.01

3. Results

The records of all respiratory distress premature neonates admitted to the hospital during the year 2013 and received surfactant (survanta) were reviewed. A total of 38 premature neonates were studied. Most of the patients (63%) were born before34 weeks of gestation, and males constitute 53 % of the study population. Birth weight of 84% of the patients was less than 2.0 kg. Caesarean section was the mode of delivery among 66% of the patients. Surfactant therapy (survanta) was administered in the 1st day of delivery for most of the patients (71%), while continuous positive airway pressure (CPAP) was used as an assisted ventilator for 76% of the patients (Table1).

Table 1.

Characters of the patients

Neonatal characters	N=38	Percentage
Gestational Age (weeks)		
26 wk – 29 wk	5	13%
30 wk – 33 wk	19	50%
34 wk – 37 wk	14	37%
Weight (kg)		
< 1 – 1.4	17	45%
1.5 – 1.9	15	39%
2.0 – 2.4	4	11%
≥ 2.5	2	5%
Sex		
Male	20	53%
Female	18	47%
Mode of Delivery		
Normal	13	34%
Caesarian section	25	66%
Complications during pregnancy		
Yes	17	45%
No	21	55%
Age when surfactant was given (hours)		
≤ 6 - 11 hr	23	60%
12 - 23hr	4	11%
24 - 35 hr	4	11%
36 – 48 hr	7	18%
Type of assisted ventilator		
Continuous positive airway pressure (CPAP)	29	76%
Intermittent positive pulmonary ventilation (IPPV)	9	24%

According to the response of the premature neonates under study (38 neonates) to the surfactant therapy, only 21 premature neonates (55%) respond and cured, while 45% of the study population did not respond and died, Fig. 1.

The main cause of death among the dyed neonates (17 neonates) was sepsis occurred in 10 premature neonates (59%), followed by pulmonary hemorrhage (29%) and respiratory failure (12%), Fig. 2.

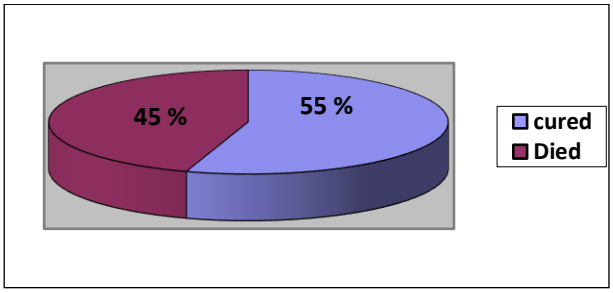

Fig. 1. Distribution of patients according to their response after receiving the surfactant therapy.

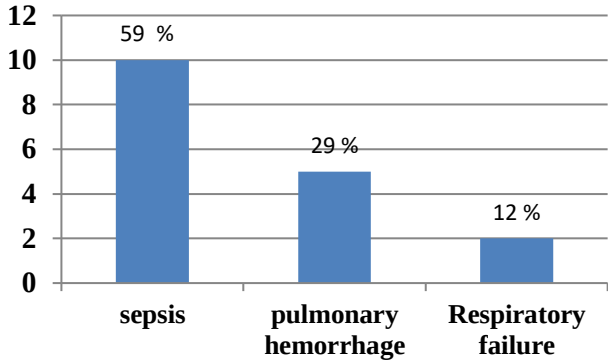

Fig. 2. Causes of death among the patients.

The results of the present study revealed a significant association between the response of the patients to the surfactant therapy and many factors like gestational age of the neonates, birth weight, complications that occurred during pregnancy, and the type of assisted ventilation was used, see Table 2.

Table 2

Factors affecting the response to the surfactant therapy among the premature neonates with respiratory distress syndrome.

Factors	Cured n = 21	Died n = 17	X^2 value
Gestational age (weeks)			
26 wk – 29 wk	1	4	6.07
30 wk – 33 wk	9	10	
34 wk – 37 wk	11	3	
Birth weight (kg)			
< 1 – 1.4	4	13	13.56**
1.5 – 1.9	13	2	
2.0 – 2.4	3	1	
≥ 2.5	1	1	
Sex			
Male	9	11	1.79
Female	12	6	
Mode of Delivery			
Normal	6	7	0.66
Caesarian section	15	10	
Complications during pregnancy			
Yes	6	11	4.96*
No	15	6	
Age when surfactant was given (hours)			
≤ 6 - 11 hr	12	11	0.92
12 - 23hr	2	2	
24 - 35 hr	2	2	
36 – 48 hr	5	2	

Level of significance * <0.05 **<0.01

4. Discussion

Analysis of the characteristics of the premature neonates participated in this study showed that the majority of the sample were born before34 weeks of gestation and their birth weight less than 2.0 kg, and this is similar to other studies (Hibbard *et al.*, 2010; Shokouhi *et al.*, 2016; Kommawar *et al.*, 2017). More than half of the patients were male and caesarian section was the mode of delivery for most of the neonates under study and these findings were approved in previous studies as risk factors for RDS among premature neonates (Barkiya *et al.*, 2016; Rao GC & Rao MSP, 2017; Adebami *et al.*, 2017).

The death rate among the premature neonates in the study after receiving surfactant therapy was 45%, which is higher than similar studies reported in Sudan and Iran (Abdelrahman *et al.*, 2014; Basiri *et al.*, 2015). The main reason of death among the study sample was sepsis which is similar to other studies (Abdelrahman *et al.*, 2014; Basiri *et al.*, 2015; John *et al.*, 2015), followed by pulmonary hemorrhage and respiratory failure.

The results of the present study revealed a significant association between gestational age of the neonates, birth weight, complications occurred during pregnancy, type of assisted ventilation used, and the response to the surfactant therapy which is similar to other studies (Hibbard *et al.*, 2010; Barkiya *et al.*, 2016; Rao GC & Rao MSP, 2017), that explained that the prognosis and severity of the neonatal RDS were inversely related to the gestational age and birth weight and increased when pregnancy complications occurred. These findings can explain why the response to the surfactant therapy was poor among our neonates. In agreement with other studies (Sakonidou & Dhaliwal, 2015; Dargaville *et al.*, 2016) and using continues positive airway pressure (CPAP) as an assistant ventilator was positively associated with the response of the surfactant therapy and good outcome.

In contrast to other studies (Parkash *et al.*, 2015; Sathenahalli *et al.*, 2016; Panda, 2017), the gender of the child, mode of delivery and timing of administration of surfactant therapy did not significantly affect the response to treatment and the outcome of the disease in the present study.

5. Study limitations:

The present study was conducted retrospectively on premature neonates who had RDS and received surfactant therapy on Benghazi pediatric hospital only, the sample size was small compared to other studies. So the obtained results cannot assess neonatal morbidity and mortality rates due to the RDS in all the country.

6. Conclusions and recommendations

The neonate respiratory distress syndrome among premature neonates can be fatal even with surfactant therapy administration, when risk factors are present as low birth weight and those born before 34 weeks of gestation and if the pregnancy was associated with complications. So the study recommends proper care of the pregnant women to decrease complications and premature delivery, improving the outcome of neonatal RDS by using an assistant ventilator for prevention of apnea and reduced neonatal mortality rate. Further studies with large sample size and proper follow up are recommended to assess the morbidity and mortality rates of neonates with RDS.

Acknowledgment

The authors would like to express their appreciation and gratitude to the staff of the medical records department at Benghazi pediatric hospital for their kind help.

References

Abdelrahman, S. M., Hamed, S. M., Nasr, A. (2014) 'Neonatal respiratory distress in Omdurman Maternity Hospital, Sudan', *Sudan J Paediatr* 14(1), pp. 65-70.

Adebami, O. J., Joel-Medewase, V. I., Agelebe, E., Ayeni, T. O., Kayode, O. V., Odeyemi, O. A., Gabriel, A. O. (2017) 'Determinants of outcome in new borns with respiratory distress in Osogbo, Nigeria', *Int J Res Med Sci.* 5, pp. 1487-93.

Avery, M. E., Mead, J. (1959) 'Surface properties in relation to atelectasis and hyaline membrane disease', *AMA J Dis Child*, 97, pp. 517-523.

Barkiya, S. M., Venugopal, N., Kumari, V. (2016) Clinico-Etiological 'Profile and Outcome of Neonatal Respiratory Distress', *Int J Sci Stud.* 2, 3(11), pp. 189-92.

Basiri, B., Esna, Ashari, F., Shokouhi, M., Sabzehei, M. K. (2015) 'Neonatal Mortality and its Main Determinants in Premature Infants Hospitalized in Neonatal Intensive Care Unit in Fatemieh Hospital, Hamadan, Iran', *J Compr Ped.*, 6(3), e26965.

Dargaville, P. A., Gerber, A., Johansson, S., De Paoli, A. G., Kamlin, C.O., Orsini, F., Davis, P. G. (2016) 'Incidence and Outcome of CPAP Failure in Preterm Infants', *Pediatrics*, 138, 1, pp. 1-12, e20153985. doi: 10.1542/peds.2015-3985.

Edwards, M. O., Kotecha, S. J. and Kotecha, S. (2013) 'Respiratory distress of the term newborn infant', *Paediatr Respir Rev*, 14, pp. 29–36.

Fedakar, A., Aydogdu, C. (2011) 'Clinical features of neonates treated in the intensive care unit for respiratory distress', *Turk J Pediatr.*, 53(2), pp. 173-9.

Fujiwara, T., Maeta, H., Chida, S., Morita, T., Watabe, Y., Abe, T. (1980) 'Artificial surfactant therapy in hyaline-membrane disease', *Lancet*,1, pp. 55-59.

Hibbard, J. U., Wilkins, I., Sun ,L., Gregory, K., Haberman, S. (2010) 'Respiratory morbidity in late preterm births', *JAMA.*, 304(4), pp. 419-25.

John, B. M., Venkateshwar, V., Dagar, V. (2015) 'Predictors of Outcome in Neonates with Respiratory Distress', *J Nepal Paediatr Soc*, 35(1), pp. 31-37.

Kommawar, A., Borkar, Vagha, J., Lakhkar, B., Meshram, R., Taksandae, A. (2017) 'Study of respiratory distress in newborn', *International Journal of Contemporary Pediatrics*, 4(2), pp. 490-494.

Lawn, J. E., Blencowe, H., Oza S., You, D., Lee, A. C., Waiswa, P., Lalli, M., Bhutta, Z. , Barros, A. J., Christian, P., Mathers, C., Cousens, S. N., Every newborn: progress, priorities, and potential beyond survival', *Lancet*, 384, pp. 189–205.

Panda, S., Aradhana, A., Mahapatra, T. (2016) 'Predictors of Mortality in Neonates with Respiratory Distress in a Tertiary Care Centre', *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 15(11), pp 62-63.

Parkash, A., Haider, N., Khoso, Z. A., Shaikh, A. S. (2015) Frequency, causes and outcome of neonates with respiratory distress admitted to Neonatal Intensive Care Unit, National Institute of Child Health, *Karachi. J Pak Med Assoc.*, 65(7), pp. 771-775.

Rao, G. C., Rao, MSP (2017) 'Etiological profile of respiratory distress in first day of life of a newborn baby', *Int J Contemp Pediatr*, 4, pp. 210-214).

Reuter, S., Moser, C., Baack, M. (2014) 'Respiratory distress in the newborn', *Pediatr Rev.*, 35, pp. 417-429.

Sakonidou, S., Dhaliwal, J. (2015) 'The management of neonatal respiratory distress syndrome in preterm infants (European Consensus Guidelines-2013 update)', *Arch Dis Child Educ Pract Ed*, 100:257, http://dx.doi.org/10.1136/archdischild-2014-306642

Sathenahalli, V. B., Dwivedi, D., Bajaj, N., Singh, H. P. (2016) 'Predictors of poor outcome in neonates with respiratory distress', *Int J Contemp Pediatr*, 3, 76-79.

Shokouhi, M., Hematpour, S., Afjeh, S. A. (2016) 'Best Strategies against Respiratory Problems in Extremely Low Birth Weight Infants', *Int J Pediatr*, 4(7), 2079-2086

Swarnkar, K., Swarnkar, M. (2015) 'Neonatal respiratory distress in early neonatal period and its outcome', *International Journal of Biomedical and Advance Research.*, 6(9), 643-647.

Zaman, S., Goheer, L., Riaz, H. (2013) 'Prevalence and etiology of respiratory distress in newborns', *Pakistan Armed Forces Medical Journal.*, 63(1), pp. 22-25.