International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

Clinical and Paraclinical Characteristics and Results of Treatment of Neonatal Respiratory Failure at the Department of Pediatrics, Khanh Hoa Provincial General Hospital in 2023-2024

My Hanh Ngo Thi[1], Thuan Ho Thi[1], Yen Hoang Thi[2]
[1]Faculty of medicine Buon Ma Thuot Medical University, Dak Lak, Vietnam-630000
[2]Medical examination Department, Dak Lak Provincial Eye Hospital - 630000
Email address: ntmhanh@bmtuvietnam.com; htthuan@bmtuvietnam.com; yenddk5@gmai.com

Abstract - *Respiratory failure is a common syndrome in the neonatal period, especially in the first days after birth. It is the leading cause of death and has high treatment costs. Respiratory failure in newborns has diverse clinical manifestations and causes, varying depending on age. The study was conducted to describe the clinical and paraclinical characteristics, causes and treatment results of respiratory failure at the Department of Pediatrics, Khanh Hoa Provincial General Hospital in 2023-2024.* ***Subjects and methods:*** *Cross-sectional study of 88 children diagnosed with neonatal respiratory failure and treated as inpatients at the Pediatrics Department of Khanh Hoa Provincial General Hospital in 2023-2024.* ***Result****: The study results showed that the male/female ratio was 1.44/1. The average gestational age was 35.1 ± 4.0 weeks with 39.8% of infants ≥ 37 weeks. The average weight was 2511.6 ± 922.8g, of which 77.3% were normal, 15.9% were malnourished, and 6.8% were overnourished. Normal birth 58.0%, postpartum asphyxia 15.9%, postpartum endotracheal resuscitation 8.0%. Mothers with risk factors 26.2%. Children < 34 weeks with full antenatal steroid prophylaxis 33.3%. Peripheral blood SpO2 < 90% 18.9%.Rapid breathing 77.3%, intercostal retractions 93.2%, altered consciousness 43.5%; body temperature changes 25.0% and heart rate changes 15.9%. Decreased pH, decreased PaO2, increased PaCO2, accounted for 65.5%; 14.5% and 16.4% respectively. Over 85% of the group of children with respiratory failure had hemoglobin, white blood cells and platelets concentrations within normal values. CRP increased > 10 mg/dL was 12.0%. Chest X-ray showed fine granular/reticular/diffuse opacity lesions in 25.0%. Mild respiratory failure in newborns was 24.1%; moderate was 58.0% and severe was 8.0%. Pulmonary causes accounted for 80.7%. Oxygen therapy, including nasal cannula oxygen 34.1%; NCPAP 52.3% and mechanical ventilation 13.6%. The results of treatment of neonatal respiratory failure were 78.4% of children recovered and were discharged from the hospital. There was a relationship between gestational age, birth weight, postnatal nutritional status, 1-minute Apgar score, balloon resuscitation, antenatal steroid prophylaxis, level of respiratory distress syndrome, SpO2 at admission, treatment time and treatment results of neonatal respiratory distress syndrome (p<0.05).* ***Conclusion:*** *This study clarifies the clinical and paraclinical characteristics, causes of neonatal dyspnea, as well as the important role of factors such as gestational age, birth weight and Apgar score in the treatment outcomes of neonatal dyspnea at Khanh Hoa General Hospital. Understanding these factors can improve management and treatment. Therefore, it is necessary to improve the expertise in neonatal intensive care and coordinate models of mother-baby resuscitation.*

Keywords *– Respiratory failure, newborn, Khanh Hoa Provincial General Hospital.*

I. INTRODUCTION

Respiratory failure is a common syndrome in the neonatal period, especially in the first days after birth. It is the leading cause of death and has high treatment costs. Respiratory failure in newborns has a wide range of clinical manifestations and causes, varying depending on gestational age and is very different from respiratory failure in children. [9]. The study was conducted on 659 newborns transferred to the Royal Sharurah Military Hospital - Saudi Arabia in 12 months, the rate of respiratory failure was 4.42% [13]. In Vietnam, statistics show that the rate of newborns with respiratory failure at the Central Maternity Hospital is 60.9% [6]. The causes of respiratory failure in newborns are very diverse, these causes can be individual or combined. However, lung diseases are the leading cause of respiratory failure in newborns, accounting for 80% of cases [5], [12]. Treatment of neonatal respiratory failure is a major challenge to stabilize the child's condition and treat the cause. At Tien Giang Central General Hospital, research showed that 78.9% of cases were successfully cured; 21% of cases progressed to more severe stages, of which 20% were transferred to other hospitals and 1.9% died in the department [4]. Therefore, studying the clinical and paraclinical characteristics and analyzing some factors related to the treatment results of respiratory failure is very necessary and useful in terms of clinical practice. Therefore, we conducted the topic: "Clinical and paraclinical characteristics and treatment results of neonatal respiratory failure at the Department of Pediatrics, Khanh Hoa Provincial General Hospital in 2023 - 2024".

II. OBJECTIVES

(1) Describe the clinical and paraclinical characteristics, causes and treatment results of respiratory failure at the Pediatrics Department of Khanh Hoa General Hospital.

(2) Analyze some factors related to the treatment results of neonatal respiratory failure at the Pediatrics Department of Khanh Hoa General Hospital. Research subjects and methods.

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III. Research Methodology

A. Study design

Analytical cross-sectional description.

B. Sample

Based on the non-probability convenience sampling criteria, 88 cases were obtained during *the* study period. Sampling criteria: All newborns ≤ 28 days old diagnosed with respiratory failure and treated at the Pediatrics Department of Khanh Hoa Provincial General Hospital from July 1, 2023 to March 31, 2024. Diagnosis of respiratory failure is confirmed when one of the criteria of the Ministry of Health in 2015: Rapid breathing > 60 breaths/min or slow breathing < 30 breaths/min; Apnea > 20 seconds or < 20 seconds with heart rate < 100 breaths/min; Signs of exertion: flaring of the nostrils or chest retraction or groaning; Cyanosis when breathing air: cyanosis around the lips, cyanosis of the extremities or the whole body; SpO2 < 90%; PaO2 < 50 mmHg and/or PaCO2 > 60 mmHg, pH < 7.25 [2].

C. Data processing

Data were cleaned and processed using SPSS 25.0 software. Results are presented in table form with information on frequency, percentage, OR and 95% CI.

D. Approval

The study was approved by the scientific council of Buon Ma Thuot Medical of University and was accepted by the research subjects. The research subjects clearly explained before collecting information. In addition, we do not use this information for any other purpose.

IV. Result and Discussion

A. General characteristics of research subjects

TABLE I: General characteristics of the study subjects

Content		Frequency (n)	Rate (%)
Sex	Male	52	59,1
	Female	36	40,9
Age (weeks)	≥ 37	35	39,8
	34 - <37	23	26,2
	32 - <34	19	21,6
	28 - <32	6	6,8
	<28	5	5,6
Birth weight (grams)	≥ 4.000	7	8,0
	2.500 - <4.000	38	43,1
	1.500 - <2.500	30	34,1
	1.000 - <1.500	8	9,1
	<1.000	5	5,7
Postpartum nutritional status	Overweight	6	6,8
	Medium	68	77,3
	Underweigh	14	15,9
Birth type	Intervention	51	58,0
	Normal birth	37	42,0
1 minute Apgar score	≥ 7	74	84,1
	< 7	14	15,9
Postpartum recovery	Breathe air	36	40,9
	Oxygen breathing	45	51,1
	Endotracheal intubation	7	8,0
Prenatal Steroid Prophylaxis <34 Weeks	No	9	30,0
	Yes	21	70,0

The study results showed that the male/female ratio was 1.44/1. The group of full-term infants (≥ 37 weeks) accounted for 39.8%. The group of infants weighing < 2,500 grams accounted for 48.9%. Infants with normal weight accounted for a high proportion of 77.3%, malnutrition accounted for 15.9% and overnutrition accounted for 6.8%. The number of patients born by cesarean section was 58.0%. The rate of asphyxia after birth was 15.9%. Among 88 patients with respiratory failure, 59.1% required respiratory support, especially 8.0% who needed a balloon to maintain breathing when transferred from the delivery room to the Pediatrics department. Most children with respiratory failure under 34 weeks receive steroid prophylaxis, accounting for 70.0%

B. Clinical characteristics of study subjects

TABLE II: Clinical characteristics of study subjects

Content		Frequency (n)	Rate (%)
Time to onset of respiratory failure	≤ 24 hours	77	87,5
	> 24 hours	11	12,5
Breathing rate (times/minute	< 30	6	6,8
	30 – 60	14	15,9
	> 60	68	77,3
SpO_2/ atmosphere	< 90%	16	18,2
	≥ 90%	72	81,8
Sense	Good contact	50	56,8
	Poor flexibility	22	25,0
	Coma	16	18,2
Heart rate (frequency / minute)	< 120	3	3,4
	120 – 160	74	84,1
	> 160	11	12,5
Intercostal retraction	Yes	82	93,2
	No	6	6,8
Sternum	Yes	65	73,9
	No	23	26,1
Shortness of breath	Yes	33	37,5
	No	55	62,5
Flaring nostrils	Yes	26	29,5
	No	62	70,5
Pathological sleep apnea	Yes	8	9,1
	No	80	90,1
Degree of respiratory failure	Light	30	34,0
	Medium	51	58,0
	Heavy	7	8,0

Respiratory failure in newborns ≤ 24 hours accounts for a high rate of 87.5%, similar to the study by Thuy Tue PhamThi and Trong Hieu Phan Nguyen and colleagues, the cases of respiratory failure in newborns on the first day were 84.0% and 79.62%, respectively [11], [4]. Children breathing > 60 times/minute accounted for the highest rate of 77.3%; followed by 30-60 times/minute accounted for 15.9% and < 30 times/minute accounted for the lowest rate of 6.8This result is similar to the study of Thien Ly Tran (2016) and Duc Tran Van (2020) in which the group of children with rapid breathing > 60 times/minute accounted for 73.7% and 64.8%, respectively [7], [10]. Children with respiratory failure with peripheral blood SpO2 from 90% or higher accounted for a high rate of 81.8%. This rate is similar to the study of Dung Hoang Thi et al. at 70.8 [3]. Children with conscious awareness accounted for 56.8%, accounting for the highest rate, followed by children with poor mobility at 25.0% and children with coma at 18.2%. In Duc Tran Van study, conscious awareness accounted for 34.6%; poor mobility

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accounted for 43%, and lethargy was common in children with severe respiratory failure at 25.2% [10]. This difference is due to the author's higher rate of preterm infants compared to our study. Among the common signs of labored breathing, our study found that intercostal retractions were the most common symptom with a rate of 93.2%, similar to Thuy Tue Pham Thi study of 95.1%. Mild respiratory failure accounted for 34.1%, moderate for 58.0%, and severe for 8.0%. The study by Thanh Binh Nguyen Thi and colleagues also showed that the rates of mild, moderate, and severe neonatal respiratory failure were 22.9%, 57.1%, and 20.0%, respectively [1].

C. Paraclinical characteristics of the study subjects

TABLE III: Paraclinical characteristics of study subjects

Content		Frequency (n)	Rate (%)
pH < 7,25	Yes	19	65,5
	No	36	34,5
PaO_2 < 50mmHg	Yes	8	14,5
	No	36	85,5
$PaCO_2$ > 60 mmHg	Yes	9	16,4
	No	46	83,6
WBC (/uL)	< 5.000	1	1,1
	5.000-25.000	79	89,8
	> 25.000	8	9,1
HGB (g/dL)	< 130	6	6,8
	130-220	82	93,2
	> 220	0	0
PLT (/uL)	< 150.000	5	5,6
	150.000-350.000	76	86,4
	> 350.000	7	8,0
Glucose/blood (mmol/L)	< 2,6	18	12,3
	2,6-8,0	61	75,3
	> 8,0	2	2,4
CRP (mg/L)	> 10	9	12,0
	≤ 10	66	88,0
Lesions on chest X-ray	Yes	65	74,9
	No	23	25,1

Among 55 children who had arterial blood gas performed, the percentages of decreased blood pH, decreased PaO2, and increased PaCO2 were 65.5%; 14.5%, and 16.4%, respectively. This rate is similar to the study of Thuy Tue Pham Thi, pH decreased by 51.2%; PaO2 decreased by 6.8% and PaCO2 increased by 24.7% [11]. he majority of newborns with respiratory failure have white blood cell count, platelet count, and hemoglobin concentration within normal limits, accounting for 85.0%. Among the study subjects, 88.0% had normal CRP. This result is equivalent to Duc Tran Van finding that 105/133 cases had blood CRP concentrations within normal limits, accounting for 78.9 [10]. 81/88 children had their blood sugar checked and the rate of hypoglycemia was 22.2%. This result is similar to the study by Thanh Binh Nguyen Thi and colleagues with 16.7% of children having hypoglycemia [1]; 74.9% of children had lesions on chest X-ray

D. Causes of respiratory failure

Respiratory failure in children due to pulmonary causes accounts for a high rate of 80.7%; of which neonatal pneumonia accounts for the highest rate of 44.4%. Next is hyaline membrane disease accounting for 25.0%.

TABLE IV: Causes of respiratory failure in study subjects

Content		Frequency (n)	Rate (%)
Causes in the lungs	Hyaline membrane disease	22	25,0
	Slow absorption of alveolar fluid	9	10,2
	Neonatal pneumonia	39	44,4
	Meconium aspiration syndrome	1	1,1
Extrapulmonary causes	Hypoxic-ischemic encephalopathy	11	12,5
	Congenital heart disease	3	3,4
	Sepsis	3	3,4

E. Some factors related to treatment results

TABLE V: Some factors related to treatment results

Content		n	No way	Rate (%)	OR, CI 95%	P
Gestational age	≥ 34 weeks	58	8	13,8	3,62 (1,26-10,37)	0,017
	< 34 weeks	30	11	36,7		
Weight after birth	≥ 2.500	46	5	10,9	4,10 (1,33-12,67)	0,011
	< 2.500	42	14	33,3		
Postpartum nutritional status	Overweight	68	10	14,7	1	0,006
	Medium	14	7	50,0	5,80 (1,67-20,13)	
	Underweigh	6	2	33,3	2,90 (0,47-17,99)	0,253
1 minute Apgar score	≥ 7	74	11	14,9	7,64 (2,22-26,31)	0,002
	< 7	14	8	51,7		
Resuscitatin	No	81	15	18,5	5,87 (1,19-29,01)	0,037
	Yes	7	4	51,1		
Antenatal steroid prophylaxis	No	9	6	66,7	0,04 (0,03-0,87)	0,015
	Yes	21	5	23,8		
respiratory failure	Light	30	2	6,7	5,81 (1,24-27,13)	0,001
	Heavy	58	17	29,3		
SpO_2/ Atmosphere	≥ 90%	71	10	14,1	1	
	< 90%	17	9	52,9		
Treatment time	< 8 day	30	12	40,0	0,09 (0,19-0,47)	0,004
	8-14 day	34	2	5,9		
	> 14 day	24	5	20,8	0,40 (0,12-1,35)	0,137

The study found a correlation between gestational age, birth weight, postpartum nutritional status, 1-minute Apgar score, balloon resuscitation, antenatal steroid prophylaxis, SpO2 at admission, treatment time and outcome of neonatal respiratory failure ($p<0.05$). The study results are similar to some studies [4]; [8]; [10].

VI. RECOMMENDATIONS

It is necessary to diagnose newborn respiratory failure early, not only based on the gold standard of arterial blood gas but also based on clinical symptoms, especially in preterm infants with risk factors for neonatal pneumonia

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