CORRELATION BETWEEN RISK FACTORS OF PEUMOTHORAX IN PREMATURE LOW BIRTH WEIGHT INFANTS AND MECHANICAL VENTILATION

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ABSTRACT

Objective: Pulmonary air-leakage especially pneumothorax (ptx), is a severe complication in neonates. Mechanical ventilation with positive pressure is one of the most common causes of these syndromes The aim of this study was to assess the predisposing factors and frequency of ptx among the low birth weight (LBW) premature infants, under mechanical ventilation.

Methods: This descriptive study was performed in 121 LBW intubated premature infants at neonatal intensive care unit of El Galaa Teaching Hospital from January 2013 to July 2013. Birth weight, gestational age(GA), sex, mode of delivery, initial diagnosis leading to ventilation, ventilatory settings, history of surfactant therapy, 5th minute apgar score were recorded in neonates with or without ptx.Statistical analysis was done using SPSS software. Univariate and multivariate regression analysis were done.

Results: A total of 42 (34.7%) infants develop ptx. Mean GA of neonates with ptx (group1) was 30±2.42 W and in neonates without ptx (group2) was 30.17±2.95 W. Mean birth weight in case and control groups were 1330 ± 386gr and 1482 ± 507gr respectively. In case group 69% and in control group 50% were delivered by cesarean section. 54.8% of cases and 53.2% of control group were male. No mentioned items reached statistical significance. Respiratory distress syndrome was the most common lung pathology in both groups. The rate of ptx was higher in cases with low apgar score at 5th minute (P=0.006). Surfactant therapy decreased the incidence of ptx (P=0.023). After multivariate logistic regression analysis only low apgar score at 5th minute significantly increased the risk of ptx.

Conclusion: The incidence of ptx in this study was slightly higher than other reports and this may be due to assessment of only LBW premature intubated neonates. After multivariate logistic regression analysis only low apgar score at 5th minute increased the risk of ptx significantly.

KEYWORDS: Apgar score, Neonate, Pneumothorax, Pulmonary Surfactant.

INTRODUCTION

Pneumothorax (ptx) is a frequently encountered surgical problem requiring urgent intervention in neonatal intensive care unit (NICU) (1). The rate can increase up to 30% in neonates who have concurrent underlying lung disease or who require mechanical ventilation(2) and the incidence varies between units with similar populations of infants(3). Ptx during respiratory distress is associated with an increased risk of intraventricular hemorrhage, chronic lung disease and death (4, 5).

Therefore it is important to consider its predisposing factors and clinical findings (1). There are few reports identifying the risk factors of neonatal ptx (6). The aim of this study is to assess risk factors and incidence of ptx in low birth weight (LBW) premature neonates who were under mechanical ventilation.

SUBJECTS AND METHODS

This study was performed on all intubated LBW premature neonates at El Galaa Teaching Hospital from January 2013 to July 2013. The inclusion criterion includes allprematureLBW infants under mechanical ventilation due to their different diseases such as Respiratory distress syndrome, Pneumonia & Sepsis, Asphyxia, Diaphragmatic hernia, and Tracheoesophageal fistula (post operation). Newborns with ptx (Group 1) were compared with those without ptx (Group 2). Data collected from all neonates included: sex, birth weight, gestational age (GA), mode of delivery, Apgar score at 5th minute, initial clinical diagnosis, surfactant therapy, occurrence of ptx, peak inspiratory pressure (PIP) and positive end expiratory pressure (PEEP) at the onset of ptx. Diagnosis of ptx was always confirmed by chest X-ray. All of the neonates were under baby log 8000 pluse-drager ventilator on SIMV mode. The neonates with ptx before intubation or with malposition of tracheal tube were excluded from study. All statistical calculations were done using computer programs SPSS V.15 for Microsoft.

RESULTS

During the specified period, 121 LBW preterm infants were under mechanical ventilation in the NICU. Among them 42 (34.7%) neonates (23male, 19female) were diagnosed with ptx (group1) and 79 (65.3%) neonates (42 male, 37

female) had not ptx (group2). Median GA and birth weight of case group were 30 ± 2.42 w and 1330 ± 386 gr respectively. Mean pip and peep at time of occurrence of ptx was 17.18 ± 2.90 (max 25) cmh2o and 3.4 ± 0.56 (max5) cmh2o respectively. In group 1, 29 (69%) neonates and in group 2, 50 (63.3%) neonates were born by cesarean section (C.S). Mean Apgar score at 5th minute in group 1 and group 2 were in this manner 6.45 ± 1.5 and 7.39 ± 1.89 (P=0.06) (table 1). Surfactant replacement therapy was done in 21 (50%) of group 1 and 56 (70.9%) of group 2 (P=0.023). Data are outlined in (table 2). The most common underlying cause of mechanical ventilation was respiratory distress syndrome (RDS) in both groups (table3).

Table (1): Demographic characteristics of studied cases.

Parameter		(Group 1) with ptx		(Group 2) Without ptx		P. Value
		No.	Percentage %	No.	Percentage %	
Sex	Male	23	54.8%	42	53.2%	0.867
	Female	19	45.2%	37	46.85%	
Birth Weight	< 1500gr	29	69%	45	46.9%	0.241
	1500-2500 gr	13	31%	34	43.1%	
	Mean	1330 ± 386gr		1482 ± 507gr		0.069
Gestational Age	< 32 w	34	81%	61	77.2%	0.817
	32-37 w	8	19%	18	22.8%	
	Mean	30 ± 2.42w		30.17 ± 2.95w		0.739
Mode of Delivery	Vaginal	13	31%	29	36.7%	0.554
	Cesarean section	29	69%	50	63.3%	
	Mean of5th minute Apgar Score	6.45 ±1.5		7.39±1.89		0.006

Table 1 shows, there is no statistically significant in these demographic items mentioned above. However, only low Apgar score at 5th minute significantly increases the risk of ptx.

Table (2): Percentage of surfactant therapy of studied cases.

Parameter	(Group 1) with ptx		(Group 2) Without ptx		P. Value
	No.	Percentage %	No.	Percentage %	
Yes	21	50%	56	70.9%	0.023
No	21	50%	23	29.1%	
Total	42	34.7%	79	65.3%	

Table 2 shows that surfactant therapy decreased the incidence of ptx (P = 0.023) and the difference is statistically significant.

Table (3): Accompanying Disorders in studied group.

Parameter	(Group 1) with ptx		(Group 2) Without ptx	
	No.	Percentage %	No.	Percentage %
Respiratory distress syndrome	26	61.9%	57	72.2%
Pneumonia & Sepsis	12	28.6%	16	20.3%
Asphyxia	2	4.8%	6	7.6%
Diaphragmatic hernia	1	2.4%	-	
Tracheoesophageal fistula (post operation)	1	2.4%	-	

Table 3 shows, Respiratory distress syndrome was the most common lung pathology in both groups.

DISCUSSION

Over 18 months, 42 (34.7%) of ventilated LBW preterm infants, developed ptx. The incidence of ptx has a wide range, varying from 1% to 30 %(3). Malek et al and Abdellatif et al found ptx in 26% and 25.7% of mechanically ventilated infants respectively (5,2). They studied both term and

preterm neonates. Lim et al reported an incidence of 1.3% in term and preterm neonates with or without mechanical ventilation (7). Difference in the rate of ptx might be attributed to different assessed groups. Since ptx is more common in

Preterm and LBW infants, our finding was slightly higher than other mentioned ranges. Our data indicated that ptx was more common in male and some other investigations have agreed with this finding (2, 5,7). Ngerncham et al found that the male sex as one of the risk factors for ptx during the first day of life(6).In the current study C.S was more common is case group with no statistical significant. Benterud et al reported that C.S was significantly associated with more frequent need for mechanical ventilation had development of ptx in preterm infants. They studied 2694 cases (8). Infants with GA < 32w in case group had higher rate of ptx than infants with same GA in control group (P=0.817). Also cases with birth weight < 1500gr had higher rate of ptx than infants with same weight in control group (P=0.241). Abdellatif et al reported the highest incidence of ptx in infants with GA < 32W (47.5%) and infants with birth weight < 1500 gr (42.37%), but they did not have any control group and 89.83% of their cases were under mechanical ventilation (2). RDS was the most common cause of mechanical ventilation and this finding is similar to some other studies (2, 5 and 9). The mean pip and peep at the onset of ptx were 17.18 and 3.4 cmH2o respectively which were relatively not high settings but might be on individual basis not the optimum setting at that time for the lung physiology. These amounts were lower than reports of Abdellatif et al (pip: 18.61 ± 4.88 and peep: 4.39 ± 0.67 cmH2o) (2) and Malek et al (PIP: 22.7 and PEEP: 4.2 cmH2o) (5). Esme et al suggested that neonatal ptx developed because of underlying lung pathology rather than being a complication of mechanical ventilation (1). By contrast a previous study mentioned that ptx in LBW infants is associated with factors present on day of ptx and not initial severity of lung disease. Vigorous control of ventilation can decreases the risk of ptx, including optimizing peep and minimizing pip (10). Also Vellank et al decreased the incidence of ptx in VLBW infants by increasing vigilance and real time monitoring of tidal volume (VT) and pip. High VT (>6cc.kg) was noted around the time of occurrence of ptx (11). One

limitation in our study was use of pressure-limited ventilator and no monitoring of VT. Another limitation was lack of comparison of respirator settings with ventilated neonates without ptx, but this was done because of the wide variation of ventilator setting for each patient during the mechanical ventilation and comparison was not done with the highest pip and peep because some of ptx occurred after starting to wean the setup rather than at maximal setting.

In the present study low Apgar score at 5th minute after birth was a significant risk factor for ptx, so effective resuscitation may reduce the risk of ptx. Mean Apgar score was 6.45 at 5th minute in case group, which is higher than 6.2in Esma et al investigation. They didn't have any control group for ptx and suggested low Apgar score as asignificant risk factors for death (1). Also Weinberger et al found that low Apgar score was associated with increased neonatal morbidity (including ptx) in preterm newborns. Antenatal maternal history and pregnancy complications were not clearly associated with low Apgar scores. Therefore they suggested that Apgar score was a useful tool in assessing neonatal short-term prognosis (12). Surfactant replacement therapy significantly reduced the risk of ptx (P=0.023). Malek et al reported the same finding (5). Meberg et al found lower risk of ptx after surfactant therapy (P>0.05) (13). After multivariate logistic regression analysis only low Apgar score at 5th minute significantly increased the risk of ptx (table1).

CONCLUSION

The incidence of ptx was slightly higher than the range mentioned in other unit due to observation of only intubated LBW preterm infants. Our findings indicate that low Apgar score at 5th minute, significantly increases the risk of ptx and surfactant therapy can decreases it.

RECOMMENDATION

This difference between two types of analysis may be due to low sample size or relationship of other factors with each other. More studies with larger sample Size is recommended.

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علاقة حدوث تسرب الهواء داخل الغشاء البلورى و التنفس الصناعى فى الأطفال ناقص النمو و الوزن

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مستشفى الجلاء التعليمى

أجريت هذه الدراسة عللى 121 طفل فى مستشفى الجلاء التعليمى فى الفترة من يناير 2013 إلى يونيه 2013 ناقص النمو و الوزن.

وقد تم دراسة العوامل التى تؤدى إلى حدوث تسرب الهواء إلى الغشاء البلورى مثل الوزن– العمر الرحمى – الجنس – نوع الولادة – والأمراض التى تؤدى إلى وضع الطفل على التنفس الصناعى و قد قسمت الحالات إلى مجموعتين:

الأولى : 42 طفل و يوجد لديهم تسريب الهواء داخل الغشاء البلورى

الثانية 79 طفل طبيعى و لا يوجد لديهم تسريب .

النتائج :

- لا توجد علاقة ذو أهمية بالنسبة للجنس – و الوزن و العمر الرحمى و نوع الولادة .
- يوجد علاقة ذو أهمية بالنسبة للإفاقة أذا تأخرت .

يعتبر RDS أكثر مرض يؤدى إلى تسريب الهواء.

استخلصت الدراسة إلى أهمية متابعة الأطفال ناقص الوزن و النمو خصوص أذا احتاجوا أفاقة لفترة طويلة والطفل الذى يعانى من أمراض التنفس و تم وضعه على تنفس صناعى لإمكانية حدوث تسرب هواء فى الغشاء البلورى.