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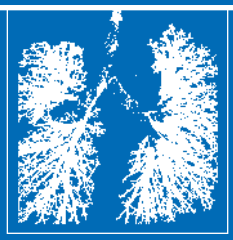
PEDIATRIC PULMONOLOGY



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Background: High flow nasal cannula (HFNC) is a novel noninvasive treatment for neonates and children with respiratory distress symptoms. HFNC is well-tolerated in young children. It has been shown to be useful in various conditions. In our Ramathibodi Hospital, we devised our modified HFNC and have been using it to treat children with respiratory distress since May 2011.
Objective: To evaluate the efficacy of modified HFNC in children with pneumonia who developed respiratory distress and to identify possible complications associated with this respiratory support.
Study design: Cohort prospective study.
Methods: This study was conducted at the Ramathibodi Hospital between April 2013–March 2014. Children younger than 10 years old with a diagnosis of pneumonia who developed respiratory distress symptoms and/or hypoxemia after receiving conventional oxygen therapy were recruited and put on modified HFNC. Heart rate, respiratory rate, and respiratory clinical score were recorded before and at 1-2 hours, 4-6 hours, and 8-12 hours after treatment with modified HFNC. Complications associated with HFNC were also recorded.
Results: Forty children met the criteria for inclusion, aged 12 (2-49 months), body weight 8.7 ± 3.6 kg. Twenty five (62.5%) were male. Heart rate, respiratory rate, and respiratory clinical score were significantly improved over time especially 1-2 hours after being on HFNC. Possible complications related to HFNC included feeding intolerance ($n = 7$, 17.5%), epistaxis ($n = 5$, 12.5%) and nasal mucosa redness ($n = 3$, 7.5%). Only 2 cases had worsening respiratory distress 12 hours after applying HFNC due to progressive pneumonia and septicemia.
Conclusion: Modified HFNC is safe and effective in the treatment of children with pneumonia. Very few minor complications are reported.

#39 - HIGH FLOW NASAL CANNULA IN CHILDREN WITH POSTEXTUBATION STRIDOR: A PILOT STUDY

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Background: High flow nasal cannula (HFNC) provides positive airway (distending) pressure and delivers warm humidified stable oxygen. These effects of HFNC theoretically may be used to treat postextubation stridor.
Objectives: To assess the efficacy and report adverse effects of HFNC in postextubation stridor.
Design: Prospective study
Setting: Pediatric intensive care unit
Subjects and Methods: Twenty one patients (aged < 8 years) with postextubation stridor, who still had Downe's croup score of > 3 after receiving IV corticosteroids, nebulized corticosteroids and epinephrine. Croup scores, comfort scores and vital signs were recorded before and at 20, 40 min, 1, 2, 3, 4, 6, 8, 10, 12 hours after administration of HFNC.
Results: There were twenty-one patients, age ranged from 1 month to 7 years. Croup score before HFNC application ranged from 3 to 6. HFNC was well tolerated in all patients. The treatment was successful in 18 patients (85.7%). All parameters of the success group were improved over time, whereas parameters of the failure group improved at the beginning but worsened after 2 hours, requiring face mask ventilation thereafter. Pneumothorax was the only complication identified in one Down syndrome patient with subpleural blebs whose atelectasis was being treated with EzPAP®.
Conclusion: HFNC is shown to be another promising alternative treatment for postextubation stridor especially in young children.

#82 - STUDY OF TRACHEAL DIAMETER AT 6 YEARS OF AGE IN INFANTS WITH TRACHEOMALACIA TREATED WITH EXTERNAL STENTING

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Purpose: Tracheo-bronchomalacia is one of the diseases where choices of treatment and management can become a burden. We have performed external stenting using vascular grafts as surgical treatment against tracheo-bronchomalacia. External stenting using a ringed vascular graft against tracheomalacia has been reported as an effective treatment, but the effect of a foreign body placed around the trachea on the development of the trachea remains a concern. We report a study of tracheal diameter at 6 years of age in infants with tracheomalacia treated with external stenting.
Methods: A Gore-tex vascular ring graft was used as an external stent in external stenting against tracheomalacia. The vascular graft was divided in 2 parts, and each was individually connected to the cartilaginous and membranous portion of the trachea. Bronchoscopy was performed during the operation and sufficient opening of the trachea was confirmed. Regular chest CT was performed for assessment of the trachea after the operation. We compared the diameter of the trachea in 9 infants in whom external stenting was performed for tracheomalacia and chest CT was available at 6 years of age, with that of 11 infants without airway diseases in whom chest CT was performed at 6 years of age. The antero-posterior and transverse diameter was measured 2cm above the carina from the axial view of the chest CT.
Results: The average age when chest CT was performed was 6.2 years, with an average of 5.6 years after the operation in infants treated with external stenting. The group without airway diseases had the chest CT performed at an average age of 6.2 years. The antero-posterior diameter and transverse diameter were 10.4 ± 1.0mm and 9.9 ± 0.8mm in the group with external stenting, and 10.1 ± 1.2mm and 10.6 ± 1.1 mm in the group without airway diseases, respectively. No significant difference was observed.
Conclusions: This study shows that external stenting against tracheomalacia did not affect the development of the trachea up to 6 years of age. Because the trachea is still developing in these infants, further studies are needed to examine the long term effects of external stenting in the development of the trachea.

#102 - INVESTIGATION OF THE EFFICACY OF AN EXTERNAL VENTILATOR (RTX®) FOR CHILDREN HOSPITALIZED WITH RESPIRATORY DISORDERS

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Introduction: The RTX® respirator (United Hayek Medical, London, United Kingdom) is an external ventilator that uses a cuirass. The cuirass is a plastic shell over the thorax, by which physiological ventilatory assistance is obtained quickly by simply making internal pressure adjustments within the cuirass. The RTX® does not cause barotrauma, volutrauma, or the possible development of pneumothorax, as seen with positive pressure ventilation (PPV). Furthermore, the clearance mode also helps to clear sputum. Because the pathophysiological characteristics (peripheral airway resistance due to small airway size, hyperplasia of bronchial goblet cells, etc.) of children often make sputum clearance difficult during respiratory disorders, use of the RTX® is thought to be effective in children who can rapidly progress to respiratory failure. We have seen that many children in a poor mood because of a respiratory disorder slept well after starting the RTX®, and their respiratory status stabilized. Therefore, we investigated the efficacy of RTX® treatment in children. Methods: An RTX® was used first in continuous negative mode for 1 to 2 hours, followed by secretion clearance mode to clear sputum. The above procedure was performed twice daily. The Modified Pulmonary Index Score (MPIS), which consists of the six categories [heart rate (HR), respiratory rate (RR), accessory muscle use, inhalation-exhalation ratio, wheezing, and SpO2] was observed on the day of starting the RTX® and the next day. The degree of improvement in each category was investigated for different levels of severity. A questionnaire was also given to the medical staff who applied the RTX® to investigate its efficacy. Results: There were 59 patients in the moderate group with MPIS ≤ 11 and 13 patients in the severe group with MPIS ≥ 12. Significant

improvements in MPIS were obtained in both the moderate and severe groups. By individual MPIS category, the level of improvement was the greatest in HR (actual data significantly decreased from 144 ± 20/min to 123 ± 19/min), followed by SpO2, wheezing, and RR. In comparison with the level of improvement in each category by level of severity, the level of improvement in accessory muscle use was found to be significantly better in the severe group. In the survey of medical staff, 13 (88%) replied that the RTX® was effective. Two major reasons were the smoothness of sputum clearance and improved sleep after wearing the RTX® compared to before use. Conclusion: The RTX® for children with respiratory disorders is an effective method by which significant improvement in MPIS is obtained regardless of the level of severity. The mechanisms for this improvement are thought to be involved in stabilizing circulatory dynamics, facilitating secretion clearance, and decreasing effort with respiration due to support of respiratory muscle use. The RTX® is a unique ventilator which aims at improving a child's breathing problem using different mechanisms from PPV.

#124 - THE EFFECTIVENESS OF INHALED NITRIC OXIDE IN CHILDREN ASSOCIATED WITH ACUTE RESPIRATORY DISTRESS SYNDROME

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Background and Objective: A growing number of studies have now been reported regarding the effects of inhaled nitric oxide (iNO) on adults with acute respiratory distress syndrome (ARDS). However, data concerning iNO on pediatric ARDS is still rare. We therefore evaluated the effects of iNO on selected oxygen indices and ventilator settings in children with ARDS.
Patients and Methods: Fifteen children with ARDS, aged between 1 and 18 years old, were admitted to the PICU from Jan 2009 to Aug 2011. Ten of fifteen children were enrolled in this study. iNO started from 20 ppm if patients showed < 88% arterial oxygen saturation despite PEEP ≧ 13 cmH2O and FiO2 ≧ 0.7. Positive response was defined as an increase in PaO2/FiO2 ratio ≧ 10 above baseline value. Two groups were studied: iNO + (response group n = 6) and iNO-(nonresponse group n = 4). We evaluated the effects of iNO on oxygen index (OI), PaO2/FiO2, PIP, FiO2 before and after 6-8 hours, 24 hours and 48 hours later for the two groups.
Measurement and Results: The use of iNO improved the ratio of PaO2/FiO2 and oxygen index in 6 of 10 children. Four of 6 children responded to iNO within 6-8 hours after introducing iNO therapy. There was neither a significant decrease in PaCO2 nor serious adverse events during iNO administration in the two groups. Methemoglobin concentration did not rise above 1.5% of total hemoglobin in any of the children and maximum NO2 concentration was 1.9 ppm.
Conclusions: Treatment with iNO may confer improvement in oxygenation and reduction of ventilator settings in children with ARDS. Effects on outcome need verification in larger controlled trials.

12. CELLULAR AND MOLECULAR BIOLOGY

#17 - EVALUATION OF SELECTED IMMUNOLOGICAL PARAMETERS IN FULL-TERM AND PRETERM INFANTS WITH RECURRENT RESPIRATORY SYMPTOMS

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The major respiratory problems in infancy and early childhood are respiratory exacerbations with airway obstruction, particularly among very immature infants. The aim of the study was to determine the distribution of T and B lymphocytes, intracellular cytokine production, total IgE and allergen-specific IgE, and to compare the obtained values in relation to gestational age and birth weight of the infants under study.
Material and methods: The preterm neonates (n = 31) were divided into three groups: < 28 weeks (n = 11), 28 < 32 weeks (n = 12) and 32 < 37 (n = 8). The control group consisted of 14 term infants. For the purpose of the study, the following data were extracted from medical records: sex, type of birth, gestational age, birth weight, APGAR score, need for mechanical ventilation, prevalence of bronchopulmonary dysplasia (BPD) and parental history of atopy. All the children presented recurrent (more than three) respiratory exacerbations with wheezing. Lymphocyte subsets were studied in peripheral venous blood: T lymphocytes including CD4 and CD8 subpopulations, B lymphocytes and natural killer cells. Intracellular cytokine production, namely IL2, IL4, IL10, IL13, was analyzed using multicolor flow cytometry. Atopic predisposition was assessed using measurements of serum concentrations of total IgE and 7 types of allergen-specific (egg white, cow's milk, soya bean, *D. pteronyssinus*, *D. farinae*, timothy grass, birth) IgE.
Results: We found a similar distribution of CD3, CD4, CD8, CD19 lymphocyte subsets. The Th1:Th2 balance presented type-1 immune response dominance. The differences in mean values of intracellular cytokine production were not significant. Total IgE and allergen-specific IgE did not differ significantly between the four groups.

Tab.1 Poster #17 Patient characteristics

Age* group	No of pts [F/M]	vaginal birth/caesarean section	gestational age [weeks] mean ± SD	birth weight [g] mean ± SD	age at evaluation mean ± SD	BPD +/−
< 28	11 [4/7]	3/8	25.9 ± 1.3	802.7 ± 189.9	1.2 ± 0.6	9/2
28 < 32	12 [4/8]	1/11	29.0 ± 1.0	1212.0 ± 381.0	0.9 ± 0.6	9/3
32 < 37	8 [3/5]	1/7	34.0 ± 2.0	2194.0 ± 315.0	0.7 ± 0.2	1/7
• 37	14 [3/11]	10/4	39.0 ± 1.4	3464.6 ± 516.9	0.7 ± 0.4	0/14

*post-menstrual age at birth

Tab. 2 Poster #17 Lymphocyte subpopulations

Age* group	CD3 [%]	CD4 [%]	CD8 [%]	CD19 [%]	IL2/CD3.4	IL4/CD3.4	IL10/CD3.4	IL13/CD3.4	Th1:Th2
< 28	63.8 ± 5.9	42.4 ± 6.3	19.3 ± 5.4	26.2 ± 7.1	30.7 ± 19.0	13.1 ± 8.0	11.1 ± 5.1	12.0 ± 6.6	1.4 ± 0.6
28<32	64.3 ± 6.8	43.6 ± 7.3	18.0 ± 5.6	29.2 ± 6.0	49.5 ± 22.4	14.9 ± 14.7	10.8 ± 8.1	18.8 ± 27.1	1.5 ± 0.6
32<37	66.5 ± 6.5	45.4 ± 6.9	19.6 ± 7.1	26.5 ± 6.8	37.4 ± 6.8	7.8 ± 5.8	6.4 ± 3.4	7.6 ± 4.4	1.4 ± 0.8
• 37	67.2 ± 6.4	46.5 ± 7.1	18.6 ± 3.3	25.9 ± 5.5	37.5 ± 14.5	12.1 ± 9.3	9.9 ± 6.7	11.1 ± 8.4	1.8 ± 1.9