УДК: 616.23/.24 – 007.17 – 053.2-07

G.S. Senatorova, A.F. Shipko, O. L. Logvinova, A.R. Muratov
OPTIMIZATION OF MEDICAL HELP FOR CHILDREN WITH BRONCHOPULMONARY DYSPLASIA
Kharkiv National Medical University, Kharkiv,Ukraine

Regional Clinical Hospital, Kharkiv,Ukraine

The problem of premature babies in the Ukraine, with beginning in the pathology of women of childbearing age, proceeds to step obstetric surveillance. The main cause of premature mortality considered disorders of the central nervous and respiratory systems, in particular the formation of severe chronic lung disease - bronchopulmonary dysplasia (BPD) [1].

Follow-up observation for preterm infants with bronchopulmonary dysplasia indicates a poor state of physical and mental development of children in older age. Scientists of the Department of Pediatrics Case Western Reserve University, USA as a result of multivariate analysis demonstrated a decline in body weight and BMI at 8 years of age in patients who had BPD. In women, these figures reached somewhere between 8 and 20 years of life. Males had remained with low body mass till 20 years [2].

Researchers at the United Kingdom by the survey 307 children aged 1 month to 11 years, showed that children with low weight at birth to 2 times more likely to carry bronchial obstruction syndrome [3]. Adults who had body weight at birth of less than 2500 g were likely to develop lungs cancer [4]. Children with bronchopulmonary dysplasia after 3 years of life had a 2-fold higher incidence of asthma, and 2.6 times higher risk of severe respiratory failure of the disease [5].

According to the Bank of U.S. children, babies with bronchopulmonary dysplasia often have immunity deficient was likely suffering from chronic heart disease and diabetes during adult life [6].

Scientists Department Fondaudiology of Brazil showed a deficit of expressive and receptive auditory and visual function in preterm infants with BPD [7]. Premature suffering from bronchopulmonary dysplasia were more frequent manifestations externalization and internalization their problems and low score IQ [8].

Thus, the problem of observation of children with bronchopulmonary dysplasia remains highly relevant, both in the world and in Ukraine. Studies are under way towards reducing the frequency of premature procreation of children, prevention of bronchopulmonary dysplasia and keeping children at all stages, on the prevention of the adverse effects of the disease. At the same time, Ukraine studies of bronchopulmonary dysplasia are extremely small, and a systematic approach and standards for the prevention and treatment of bronchopulmonary dysplasia is missing.

Aim. The aim of study is improve health care for children with bronchopulmonary dysplasia by evaluating gender distribution, dynamics and structure of morbidity in the last 7 years, developing recommendations for the frequency of clinical pulmonary supervision of a child with BPD.

Materials and Methods. The study involved 249 patients from 1 to 36 months years, of which 206 patients (86.56+0.02%) patients with bronchopulmonary dysplasia in remission of the disease (group of study) and 43 children (21,06+2, 92 %) who were born prematurely, had respiratory disorders in the early neonatal period, but did not form of BPD (comparison group) . Children were observed from 2007 to the first quarter of 2014 in Regional Clinical Hospital at the Regional Center for diagnosis and treatment of bronchopulmonary dysplasia in infants.

The diagnosis of bronchopulmonary dysplasia was established by the International Classification of Diseases, X review. Statistical analysis was by program «Statistica- 6". It was done the recommendation program the frequency of clinical pulmonary supervision of a child with BPD/

Results and discussion. The survey in the study group and the comparison group were found significantly more men (p <0.01 - 0.0001). Distribution results are presented in table 1. This suggests the predominance of male children among premature babies.

Table 1

There is distribution by sex of patients with BPD (group of study; n = 206) and patients who were born prematurely, had respiratory disorders in the early neonatal period, but did not form of BPD (comparison group; n = 43)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Number of males (m.) | Number of females  (f.) | р m. – f. |
| абс. | M+m% | абс. | M+m% |
| 1-Group of study | 123 | 59,7+3,4% | 83 | 40,3+3,4% | 0,000074 |
| 2-Comparison group | 28 | 65,1+7,3% | 15 | 34,8+7,3% | 0,0043 |
| р 1-2 | 0,526 | 0,526 |  |

Note: - Differences are significant (X 3 - p <0.001, X 4 - p <0.0001)

Gender difference between the new form of BPD (NF - BPD ) and classical form BPD (СF - BPD ) was analyzed the distribution by sex depending on the form of the disease. These data indicate a significant difference in gender affiliation (KW H = 23,3; p < 0.05). Thus, the CF- BPD patients ratio males: females was like 1,8:1 respectively. Among patients with NF - BPD - males: females = 1: 0,8. In children with BPD term (BPD -T) - males: females = 2: 1. Data was differ from the results of studies by other authors. We is suggesting the feature of gender distribution of children according to the forms of bronchopulmonary dysplasia among patients from different regions [9].

Distribution of children by type and incidence of BPD per year is presented in table 2. Frequency of form bronchopulmonary dysplasia was like NF- BPD: CF-BPD: BPD-T belonged as 7: 2: 1 respectively. Reliably prevailed patients with a new form of bronchopulmonary dysplasia (67,9 +3,2%, p <0,001-0,0001).

The analysis showed a sharp increase the relative number of patients with NF-BPD. During the period 2008-2010 y.y. percentages of patients with NF-BPD was 34,5+3,2% (28 patients). From 2011 to 2013 the relative number of patients with new forms was significantly increased 2,2% to 94% (110 patients, p <0,0001). This trend was due to increasing use of benign options ventilation and surfactant children with very low birth weight and extremely low weight due to the transition to international standards of neonatal care for preterm years. Patients with classic shape made up a fifth of (21,8+2,9%) patients with BPD. During 2008-2010 y.y. identified 36 patients with CF-BPD (44,4 +5,5%). From 2011 to 2013 number of CF-BPD was decreased to 4,3 +1,8% (5 patients, p <0,0001). The reason for this trend was rare use of "hard" parameters of artificial ventilation and the increased frequency of surfactant therapy in preterm modern resuscitation.

From 2007 to the first quarter of 2014, observed 21 children with term BPD, which was at 10,2+2,1% of patients with BPD. All children with BPD-D suffered from comorbid diseases in the neonatal period, requiring mechanical ventilation holding high the mean airway pressure with exposure to neuro-respiratory drive. Higher detection rate term BPD (10%, compared to 5% according to Ovsyannikova D.Y.) we explain the localization children with serious heart defects and congenital disorders of the central nervous system in the profile for this disease hospital where was the regional center of bronchopulmonary dysplasia. Severe congenital and hereditary diseases, long-term, using "hard" mode, ventilation, repeated surgery on congenital heart defects in the neonatal period, contributed to the infringement of pulmonary hemodynamics and neuro-respiratory drive.

The distribution of patients with BPD severity of the disease is presented in table 3. Among children with BPD was significantly more often diagnosed with mild of BPD (172 patients; 83,5+2,6%, p <0,0001), corresponding to global trends and shows the predominance of nonindependent oxygen patients with BPD today.
The most commonly diagnosed mild BPD in children with NF-BPD, at least - with CF-BPD. The structure of the NF -BPD and CF-BPD moderate and severe disease severity ranged from 4,2% to 8,8%.

Mild disease was diagnosed only ¼ of the patients with BPD-T. However, in children with bronchopulmonary dysplasia term significantly more often observed in the average severity of illness (p = 0,00001), which ran with dependence on oxygen support and subsidies need oxygen by nasal cannula / nasal catheters / through the mask with oxygen concentrator with FiO2 – 0,3-0,4. We assumed comorbid effect on the oxygen dependence in patients with BPD-T.

Frequent complication of BPD were pulmonary hypertension (176; 76,6+1,6%; KW H = 14,5; p <0,05) and respiratory failure (177; 77,9 +1,6%; KW H = 14,7, p <0,05). In the patients revealed atelectasis of the lungs 12; 5,8 +3,2%, malnutrition, and 32; 15,5 +2,7% (KW H = 14,5; p <0,05).

Patients with bronchopulmonary dysplasia (n = 206) were observed at the center for 3 years, including children 1 year of 160 (77,6+3,1%) children 2 years 115 (55,8+3,2%) patients and 3 years or more 88 (42,7+2,8%) patients. To determine the frequency of reviews recommendations for pulmonologists children with BPD need for monitored monthly subsidy of oxygen, the degree of respiratory failure, every three months determine the severity of symptoms of BPD (hyperpneumatoses, depletion, vascular deformation pattern, pneumofiborosez). Since the first year of life in children with light severity of BPD had had discrimination respiratory changes proving every three months (p <0.05), with a moderate severity of BPD (p <0.01) and severe severity of BPD (p <0.001) per month. In the second year of life, discrimination on respiratory parameters had observed in every six months for children with light severity of BPD (p <0.05), 1 in every 3 months in patients with moderate (p <0.05), and monthly in patients to severe BPD (p <0.001). For the third year in children with mild BPD of functional and morphological changes in the respiratory system had not defined (p <0.0001), in children with moderate severity BPD was defined discrimination on functional changes every 6 months (p <0.05). In patients with severe BPD changes of functional parameters was identified per month (p <0.0001). Based on these data we worked out the frequency of reviews by pulmonologist during the clinical examination of the patient (table 4).

Table 4.

The recommended frequency of reviews by pulmonologist children with BPD

|  |  |
| --- | --- |
| Severity of BPD | Age |
| till 6 month | 6-12 months | 12-36 months |
| Mild BPD | 1 time per 3 month | 1 time per 6 month | as needed |
| Moderate BPD | Every month | 1 time per 3 month | 1 time per 6 month |
| Severe BPD | Every month | Every month | Every month |

The recommended frequency of reviews pulmonologist during clinical examination of children with bronchopulmonary dysplasia tested on 156 patients. According to a study formed 2 groups: the first group (123 patients), children with BPD observed under the recommended frequency; in the second group (33 patients) were observed each quarter.

In analyzing the results of clinical examination of 123 patients were observed under the recommended frequency, only 4 children clinical examination was ineffective. In the group of children who were observed each quarter in 19 patients observed was ineffective (table 5).

Table 5.
The detection rate of effective / ineffective observed
  the results using the recommended frequency of reviews pulmonologist children with bronchopulmonary dysplasia

|  |  |  |  |
| --- | --- | --- | --- |
| Еffective / ineffective observed   | Effective observed | Iineffective observed  | In general |
| Children with BPD who were seen by the recommended frequency | 119 А | 4 В  | 123 |
| Children with BPD who observed each quarter | 9 С  | 24 D | 33 |
| In general | 133 | 23 | 156 |

Reliability and validity of the recommended frequency of reviews pulmonologist during clinical examination of children with bronchopulmonary dysplasia were determined by two tests: sensitivity and specificity (formulas 1 and 2)

Specificity = A / ( A + C ) \* 100 % = 119 / (119 + 9 ) \* 100 % = 92, 96% ( 1)

Sensitivity = D / (D + H) \* 100% = 24 / (24 + 4) = 85.7 % (2 )
Thus, detected with high sensitivity ( 92,96 %) and specificity ( 85,7%) indicate a significant reliability using the recommended frequency of reviews pulmonologist during clinical examination of children in bronchopulmonary dysplasia in ambulatory conditions .

Conclusions:
1. Revealed significant differences in gender affiliation surveyed in favor of males among children with BPD (KW H = 23,3; p < 0.05).

2. The structure of bronchopulmonary dysplasia incidence of NF - BPD : CF - BPD : BPD -D belonged as 7: 2: 1, respectively.

3. Based on the data developed by the frequency of reviews pulmonologist during clinical examination of the patient, which showed high sensitivity ( 92.96 %) and specificity ( 85.7%) , indicating a significant reliability using the recommended frequency of reviews pulmonologist during clinical examination of children in bronchopulmonary dysplasia in ambulatory conditions .

Table 2

Distribution of children with bronchopulmonary dysplasia (study group; n = 206)
by type of disease and the incidence of a year

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Years of survey | СF-BPDn=45 | NF-BPDn=140 | BPD-Tn=21 | In general per year | р | р | р |
| abs. | M+m% **1** | abs. | M+m% **2** | abs. | M+m%**3** | abs. | M+m% | **1-2** | **2-3** | **1-3** |
| 2007 | 4 | 1,9+0,9% | 1 | 0,5+0,5% | 2 | 0,9+0,6% | 7 | 3,4+1,3% | 0,177 | 0,563 | 0,412 |
| 2008 | 11 | 5,3+1,5% | 4 | 1,9+0,9% | 6 | 2,9+1,2% | 21 | 10,2+2,1% | 0,065 | 0,523 | 0,213 |
| 2009 | 14 | 6,7+1,7% | 6 | 2,9+1,2% | 5 | 2,4+1,1% | 25 | 12,1+2,2% | 0,066 | 0,761 | 0,033*1* |
| 2010 | 11 | 5,3+1,6% | 18 | 8,7+1,9% | 6 | 2,9+1,2% | 35 | 17,9+2,6% | 0,242 | 0,018*1* | 0,216 |
| 2011 | 3 | 1,4+1,6% | 27 | 13,1+2,3% | 1 | 0,5+0,5% | 31 | 15,0+2,5% | <0,0001*4* | <0,0001*4* | 0,316 |
| 2012 | 1 | 0,5+0,5% | 39 | 18,9+2,7% | 1 | 0,5+0,5% | 41 | 19,9+2,7% | <0,0001*4* | <0,0001*4* | 1,00 |
| 2013 | 1 | 0,5+0,5% | 44 | 21,3+2,8% | 0 | - | 45 | 21,8+2,9% | <0,0001*4* | <0,0001*4* | 0,317 |
| І quarter 2014 | 0 | - | 1 | 0,5+0,5% | 0 | - | 1 | 0,5+0,5% | <0,0001*4* | <0,0001*4* | 1,00 |
| The total number of surveyed | 45 | 21,8+2,9% | 140 | 67,9+3,2% | 21 | 10,2+2,1% | 206 | 100% | <0,0013 | <0,0001*4* | <0,012 |

Note:

- reliable difference (Х *1*– р<0,05; Х *2*– р<0,01; Х *3*– р<0,001; Х *4*– р<0,0001)

Table 3.

Distribution of children with bronchopulmonary dysplasia (study group; n = 206)
severity of the disease

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Severity | СF-BPDn=45 | NF-BPDn=140 | BPD-Tn=21 | In general  | р | р | р |
| abs. | M+m% **1** | abs. | M+m% **2** | abs. | M+m%**3** | abs. | M+m% | **1-2** | **2-3** | **1-3** |
| Mild BPD (Mild) | 38 | 84,4+5,4% | 129 | 92,1+2,3% | 5 | 23,8+0,9% | 172 | 83,5+2,6% | 0,13 | 0,00014 | 0,000014 |
| Moderate BPD(Mod.) | 4 | 8,8+4,2% | 5 | 3,5+1,6% | 13 | 61,9+10,8% | 22 | 10,7+2,2% | 0,15 | 0,000014 | 0,000014 |
| Severe BPD(S) | 3 | 6,6+3,7% | 6 | 4,2+1,7% | 3 | 14,3+7,8% | 12 | 5,8+1,6% | 0,52 | 0,06 | 0,32 |
| р Mild.- Mod. | 0,0013 | 0,00014 | 0,012 | 0,0013 |  |
| р Mod..- S. | 0,691 | 0,759 | 0,0009 | 0,0013 |
| р Mild.- S. | 0,000014 | 0,0013 | 0,441 | 0,073 |

Note:

M + m% \* - the average and standard error of the mean within the same form of the disease to the representativeness of the results

- reliable difference (Х *1*– р<0,05; Х *2*– р<0,01; Х *3*– р<0,001; Х *4*– р<0,0001)

Literature

1. Bronchopulmonary dysplasia: Clinical grading in relation to ventilation/perfusion mismatch measured by single photon emission computed tomography [Electronic resource]. / M. Kjellberg , K. Björkman, M. Rohdin, et al. // // Pediatr Pulmonol. – 2013. – Access mode: <http://www.ncbi.nlm.nih.gov/pubmed/23359534>
2. [Bose C. Fetal growth restriction and chronic lung disease among infants born before the 28th week of gestation / C. Bose, L. J. .Van Marter, M. Laughon [et al.] // Pediatrics. – 2009. – Vol. 124. – P. 450.](http://www.uptodate.com/contents/pathogenesis-and-clinical-features-of-bronchopulmonary-dysplasia/abstract/24)
3. Aerobic capacity and exercise performance in young people born extremely preterm / H. Clemm, O. Roksund, E. Thorsen, Pediatrics, et al.// – 2012. – № 129. – P. 97-105.
4. Airway delivery of mesenchymal stem cells prevents arrested alveolar growth in neonatal lung injury in rats. / T. Van Haaften, R. Byrne, S. Bonnet, et al. // American Journal of Respiratory and Critical Care Medicine. – 2009. – № 180(11). – P. 1131-1142.
5. [Brion L.P. Aerosolized diuretics for preterm infants with (or developing) chronic lung disease [Electronic resource] / L. P. Brion, R. A. Primhak, W.Yong // Cochrane review in The Cochrane Library. – 2003 – Режим доступу: http://www.nichd.nih.gov/cochraneneonatal/brion](http://www.nichd.nih.gov/cochraneneonatal/brion)
6. Bronchopulmonary dysplasia / R. L. Kair, D. T. Leonard, J. M. Anderson, et al. // Pediatrics in Review. – 2012. – № 33. – P. 255.
7. Bronchopulmonary dysplasia and emphysema: in search of common therapeutic targets. / Bourbon J. R., Boucherat O., Boczkowski J., et al. // Trends in Molecular Medicine. – 2009. – № 15(4). – P. 169-179.