Yeditepe Medical Journal 2009;(11):220-226

Pulmonary Rehabilitation and Encountered Difficulties In Disabled Children

Özürlü Çocuklarda Pulmoner Rehabilitasyon ve Karşılaşılan Güçlükler

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ABSTRACT

Disability, defined as "any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being" (ICIDH) (World Health Organization, 1980). Approximately 12% of Turkey's population is known to be as disabled. Accordingly, there are 8.5 million disabled persons (1). Respiratory infection and reduced pulmonary functions in disabled children are the most important reasons of morbidity, and mortality. Incidence of pulmonary complications is very high and the largest reason of hospitalization. Recurrent pulmonary problems in disabled children effects greatly both health and the quality of life however it is important to know that respiratory complications in disabled children can be prevented and treated (2-5). This review deals with the pulmonary rehabilitation program and encountered difficulties in disabled children.

Keywords: *Disabled Child, Respiratory Complication, Pulmonary Rehabilitation*

ÖZET

Özürlülük "bir eksiklik sonucu meydana gelen ve normal sayılabilecek bir insana oranla bir işi yapabilme yeteneğinin kaybedilmesi ve kısıtlanması durumunu ifade eder." (ICIDH) (World Health Organization, 1980). Türkiye nüfusunun yaklaşık % 12'sinin özürlü olduğu bilinmektedir. Buna göre 8,5 milyon özürlü olduğu ortaya çıkmıştır (1). Özürlü çocuklarda respiratuar enfeksiyon ve azalmış pulmoner fonksiyonlar morbidite ve mortalitenin en önemli nedenleridir. Pulmoner komplikasyonların insidansı ise çok yüksek olup hastane yatışlarının en büyük sebebidir. Özürlü çocuklarda

tekrarlayan pulmoner problemler hem sağlık hem de yaşam kalitesini büyük ölçüde etkiler. Ancak özürlü çocuklarda respiratuar komplikasyonların engellenebilir olması ve tedavi edilebilir olması önemlidir (2-5). Bu derleme özürlü çocuklarda pulmoner rehabilitasyon programını ve karşılaşılan zorlukları ele almaktadır.

Anahtar Kelimeler: *Özürlü Çocuk, Respiratuar Komplikasyon, Pulmoner Rehabilitasyon*

INTRODUCTION

The Pulmonary Rehabilitation Committee of the American College of Chest Physicians defined pulmonary rehabilitation as; "an art of medical science wherein an individually tailored multidisciplinary program is formulated which, through accurate diagnosis, therapy, emotional support and education, stabilises or reverses both the physiology and psycho-pathology of pulmonary disease and attempts to restore the patient to the highest possible functional level allowed by his pulmonary handicap and over-all life situation" . In relation to the national institute of health the new definition of pulmonary rehabilitation treatment is "a multidisciplinary continuum of services directed to persons with pulmonary disease and their families, usually by an interdisciplinary team of specialists, with the goal of achieving and maintaining the individuals maximum level of independence and functioning in the community" (Cole and Fishman, 1994) (6-8). The more recent definition explicitly states that the goal of pulmonary rehabilitation is to achieve and maintain "independence and functioning in the community". Greater recognition is made of the role families play in the management of the disease and the need for interdisciplinary working. Thus, health professionals must not merely work side by side in the provision of rehabilitation but must ensure an integrated programme is delivered where individual roles complement each other without unnecessary duplication (8).

Respiratory problems occur according to the child's current disability. Causes are related to many factors so it is important to focus on all related factors as well as the anatomical and physiological differences in children's respiratory care (9). The most causes of mortality in children with cerebral palsy (CP) are due to respiratory problems associated with infections. The high incidence of respiratory diseases in children with CP is related to physiopathological factors associated with neuromuscular dysfunctions. Recurrent pulmonary problems such as pneumonia, atelectasis, bronchiectasis, and restrictive lung disease threaten significantly both health and quality of life. But these respiratory complications can be prevented and treated. Treatment must include daily airway clearance and aggressive bronchial hygiene (3). Severely retarded children have swallowing difficulties, gastrointestinal and nutritional problems (3,4,9,10). Chest development and shape in children with severe neurological defects may be different and they cannot control the trunk, upper extremities and neck muscles significantly. Diaphragm and abdominal muscles are weak and the cognitive problems make the condition even more complex (2-5,11,12).

The cardiovascular abnormalities and congenital airways anomalies are common in Down Syndrome and they cause respiratory problems (4). Patients who have very little tidal volume and decreased coughing activity are exposed to *atelectasis*, retention of secretion and respiratory infection. Weakness of intercostals, abdominal and spinal extensor muscles in disabled children reduce the effectiveness of diaphragm. Chest expansion and ventilation in three plans (anterior-posterior, inferior-superior, lateral) is affected causing decreased pulmonary function (10,13).

Causes of Respiratory Problems in Disabled Children

1-Immobilization (8,9,14).

2-Peripheral and respiratory muscle weakness (3).

3-Severe spinal and chest deformities (8,9,14).

4-Inactive cough (3).

5-Gastroesophageal reflux, dysphagia and disease attacks (8,9,14).

6-Mucociliary transport dysfunction (8,9,14).

7-Excessive secretion production (8,9,14).

8-Malnutrition (8,9,14).

9-Developmental deficiency (8,9,14).

10-Muscles tone disorders (3).

11-Secondary contractures due to immobilization (8,9,14).

12-Congenital anomalies (especially the lower air tract anomalies) (8,9,14).

13-Cardiac anomalies (8,9,14).

Encountered Difficulties in Pulmonary Rehabilitation

1-Reduced ventilatory stimulation and ventilation (3).

2-Low exercise capacity (3).

3-Relative obesity (3).

4-Restrictive lung diseases (3).

5-Obstructive lung diseases (3).

6-Inactive cough (2-5,8,9,14).

7-Chronic aspirations (due to dysphagia, gastroesophageal reflux and attacks) and frequent pneumonia (2-5,8,9,14).

8-Problems of secretion clearance (2-5,8,9,14).

9-Immune system disorders and decreased body resistance (2-5,8,9,14).

10-Insufficient development of abdominal and respiratory muscles (2-5,8,9,14).

11-Hypotonia, hypertonia, spasticity, muscles imbalance and weakness (2-5,8,9,14).

12-Peripheral and respiratory muscle weakness (2-5,8,9,14).

13-Frequent anesthesia due to surgical corrective interventions for congenital structures and cardiac anomalies (3).

14-Insufficient muscles and skeleton support due to positioning and immobility (3).

15-Common deformities and secondary contractures (2-5,8,9,14).

16-Oral motor control dysfunctions and communication problems (2-5,8,9,14).

17-Malnutrition (2-5,8,9,14).

18-Developmental and growth problems (2-5,8,9,14).

19-Respiratory insufficiency and complications (2-5,8,9,14).

20-Stress and lack of motivation (2-5,8,9,14).

Factors Affecting Secretion Clearance

1-Insufficient mucociliary clearance mechanism (3).

2-Excessive secretion production (3).

3-Dense secretion (3).

4-Inactive cough (2-5).

5-Restrictive lung diseases (2-5).

6-Immobilization and insufficient exercises (2-5).

7-Dysphagia and aspiration (2-5).

8-Gastroesophageal reflux (3).

Effective coughing reflex, normal functional mucociliary structure and non-obstructed airway are required for normal airways clearance (3).

Secretion Clearance Problems Lead to:

1-Airways obstruction (8,15).

2-Mucous stopple (8,15).

3-Atelectasis (8,15).

4-Problems of gas exchange (8,15).

5-Infections (8,15).

6-Inflammations (8,15).

Component of Pulmonary Rehabilitation

1-Assessment (6-8,15).

2-Patient and family instruction (6-8,15).

3-Physical therapy and exercise program application (6-8,15).

4-Providing appropriate nutrition principles (6-8,15).

5-Providing psychosocial support (6-8,15).

6-Follow-up and re-assessment (6-8,15).

Goals of Pulmonary Rehabilitation Programs:

1-Increase exercise tolerance and encourage long-term exercise (17).

2-Reduce breathing difficulties (6-8,15).

3-Increase peripheral and respiratory muscle strength and endurance (17).

4-Improve quality of life (6-8,15).

5-Increase independence in daily living activities (6-8,15).

6-Inform the patient about the status of the lungs and provide maintenance of self-treatment (17).

7-Ensure active participation of the patient to treatment (6-8,13,15-17).

8-Improve ventilation and oxygenation (6-8,13,15-17).

9-Provide breathing control (6-8,13,15-17).

10-Decrease oxygen consumption (6-8,13,15-17).

11-Maintain secretion clearance (6-8,13,15-17).

12-Maintain sufficient coughing (6-8,13,15-17).

13-Prevent or/and treatment the complications of immobilization (6-8).

14-Maintain normal posture (6-8,13,15-17).

15-Increase the mobility (6-8,13,15-17).

RECOMMENDATIONS

Appropriate positioning of disabled children encourages the normal development of the chest. It is important to change the position during the day and positions that increase pulmonary stress must be avoided. The sleeping position must be adjusted to provide comfort-breathing patterns. For optimal pulmonary function and normal chest development the erect trunk position is important and must be facilitated. Chest expansion of

patient who wears corrective or preventive apparatus (such as spinal brace) may be affected. Supine position decreases the PaO2 while the prone position in small children improves the tidal volume and the coordination between chest cage, diaphragm and abdomen. Lying side position facilitates the secretion drainage from the upper region of the lung. Small children with unilateral lung problems are positioned on the affected side to provide maximum oxygenation. This position is opposite to that which used in the same conditions in adults. Lying side position provides practically driving aerosol/inhalation treatment. Sitting position increases the lung volume and functional residual capacity more than supine position (9,10,18-20). Nwaobi et al. (21) measured the vital capacity (VC), forced expiratory volume in one second (FEV) and expiratory time (ET) of eight children with CP aged between 5 and 12 years, when seated in a regular sling-type wheelchair and in an adaptive seating system. The results showed a 57.7% increase in VC, a 51.6% increase in FEV1 as a percentage of VC, and a 55% increase in ET in the adaptive seating system compared with the standard wheelchair. The adaptive seating is the position of choice for children with CP. This position enhances feeding and the function of alimentary system. It minimizes obstruction of respiratory airways as well as it maximizes the pulmonary function especially during prolanged seating. Adaptive seating position effects the functional residual capacity as it relates to preventing alveolar hypoxia and subsequent pulmonary hypertension.

Early initiation of pulmonary rehabilitation in disabled children is essential. Ersöz et al (22) evaluated chest mobility by means of chest expansion (CE) measurements in patients with spastic CP. Chest circumference at maximal voluntary inspiration (Cinsp) and at maximal voluntary expiration (Cexpir) and CE (the difference between Cinsp and Cexpir) were measured in 56 consecutive inpatients with spastic CP and in 40 healthy children. CE was significantly decreased and Cexpir was increased in the CP group. The difference between CP patients and controls with respect to CE was becoming more prominent in older children. The authors demonstrated that chest mobility is decreased in spastic CP patients so early initiation of pulmonary rehabilitation, which may improve and maintain chest mobility and respiratory function, seems reasonable in this patient group.

It is important to instruct the disabled children relaxation techniques and effective coughing, for small children coughing is stimulated using specific techniques such as huffing, manual pressure, percussion, vibration, shaking and trachea stimulation. Modified postural drainage is recommended. Breathing exercises (diaphragmatic, pursed lip breathing, segmental and low frequency breathing exercises) as well as keeping breathing with maximum inspirium exercises are also recommended.

Bronchial hygiene techniques, sufficient liquid intake and maintaining bronchial moisture must be obtained. Postural drainage, forced expiration techniques nasopharyngeal suction also may be applied. Posture exercises, mobilization, biofeedback, environment modification and techniques of oxygen consumption decrease must be added to the rehabilitation program. Patients may benefit from assistive techniques which may be invasive approaches such as CPAP (continuous positive airway pressure), IPPB (intermittent positive pressure breathing) and PEEP (positive expiratory end pressure), or not invasive such as PEP (positive expiratory pressure), threshold-IMT (inspiratory muscle training), IS *(incentive spirometry),* Flutter, Cornet, mechanic insufflations and exsufflation, high frequency chest wall oscillation (vest system) and cough machine. Oxygen treatment and inhalation as well as motivation are important bases (2-5,12,15,18-20).

A study showed that IPV (Intrapulmonary percussive ventilation) more effective and reliable than incentive spirometer application in patients with neuromuscular diseases, IPV as part of a preventive pulmonary regimen reduced days of antibiotic use and hospitalization for respiratory illness in adolescents with neuromuscular disease (2). It has been demonstrated that positive expiratory pressure (PEP) treatment is appropriate and tolerable with effective results for non- cooperated severely disabled children. Thus after PEP treatment PO2 increased significantly, PCO2 and respiratory rate did not show any changes. Clearance of airways reduced significantly obstruction of airways and improved breathing. Oxygenation and quality of life also has been improved (20).

Intermittent positive pressure breathing is effective to initiate coughing in patients who cannot breath deeply but it requires necessary force for synchronous inspiration. Using a Flutter requires closure of the mouth. Cooperation, endurance and power are required for exhalation control. High frequency oscillation of chest wall contributes to mobilization and loosening of the secretion, this method is effective for patients who cannot participate physically and cognitively in treatment. Using an in-exsufflator is appropriate for patients with weak respiratory muscles (3).

Appropriate sportive activities such as swimming also have a positive effect on pulmonary functions. Hutzler et al. (23) evaluated the effect of a 6-month movement and swimming program on the respiratory function of children with CP. Forty-six kindergarten children aged 5 to 7 years were assigned either to a treatment or control group. The intervention program consisted of swimming sessions twice weekly and sessions of group physical activity in a gym once weekly, each session lasting 30 minutes, for a period of 6 months. Children in the control group were treated (30 minutes, 4 days per week) with Bobath physical therapy. The children in the treatment and control groups had comparable disability types, age, and anthropometric measurements. The results confirmed that children with CP have reduced lung function compared with normative data for children in the same age category. The treatment program improved baseline vital capacity results by 65%, while children in the control group improved by only 23%. The movement and swimming exercise program had a better effect than a physical therapy routine consisting of respiratory exercise alone.

Treatment method, which will be used, must be appropriate to the indications and sometimes despite of present indications patients may be unstable. Some problems such as gastroesophageal reflux, temporary hypoxemia, low cardiac output, pulmonary hypertensive crisis may be presented so if treatment is indicated for the patient, precautions must be taken (3-5,9,10,12,13,18). Appropriate test and evaluation methods should be identified according to the patient disability with the physical capabilities. Social, psychological, and mental development should be considered. Physiotherapy and rehabilitation program should be planned appropriately according to patient's conditions. Risk factors should be evaluated carefully in children with problems in pulmonary secretion clearance (3,12,18).

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