

## Child's play: an insight into paediatric physiotherapy in Ireland



*An image from 1953 showing the physical therapist assisting two children with polio holding on to a rail while they exercise their lower limbs. (Courtesy: CDC/Charles Farmer.)*

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### Introduction

The role of the paediatric physiotherapist has evolved considerably over the past 20 years because of improved understanding of paediatric illness and an increase in research devoted to this area. This branch of physiotherapy aims to enable the child to reach his/her full potential through developmental play, therapeutic exercise and functional training activities, with a focus on the role and involvement of the parent and extended family.<sup>1</sup> The evolution of interventions that concentrate on function instead of impairment, as well as improved understanding of development – such as the neuromaturational theory, the dynamic systems theory and the neuronal groups selection theory – has facilitated rapid improvement in paediatric

rehabilitation over the past two decades.<sup>2</sup>

Modern paediatric physiotherapy has expanded to become more than just intervention, such as airway clearance or exercise prescription. Instead, the individual physiotherapy regime is now considered in conjunction with the active participation of the family or carer, and with the acknowledgment of influencing factors such as age, motor ability, learning development, personality, culture and personal ambition.<sup>3</sup> The paediatric physiotherapist has “historically been involved with every aspect of childcare, giving valued support and advice to families and carers and undertaking at times very structured therapy programmes and exercise regimens”.<sup>4</sup> In Ireland, paediatric physiotherapists work with children in a variety of settings, including

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special schools, hospitals, primary care teams and at home.<sup>1</sup> These physiotherapists deal with a diverse group of diseases, such as cystic fibrosis, cerebral palsy, spina bifida, congenital syndromes and postural problems. Their goal is to facilitate development, growth and achievement of full potential as an adult.<sup>2</sup> Chartered paediatric physiotherapists are closely involved in nationwide health initiatives, such as the recent 'Move4health', which aims to combat rising obesity levels in children.<sup>5</sup> Irish physiotherapists also work with charities such as Enable Ireland to provide assistance, advice and treatment to children with disabilities and their families.<sup>6</sup> A number of physiotherapy teams have also flown to Haiti from Ireland to assist in the rehabilitation of children injured in the earthquake, providing vital care and support to these children and their families. This article will examine the role of the paediatric physiotherapist in the country's largest paediatric hospital, Our Lady's Children's Hospital in Crumlin (OLCHC). A brief overview of physiotherapy treatments and practice for cystic fibrosis (CF) in OLCHC will be provided, along with the incidence, prevalence and clinical features of the disease, and current research regarding physical management.

### **Our Lady's Children's Hospital, Crumlin**

OLCHC was opened in 1956 and is Ireland's largest paediatric hospital, providing the majority of the country's tertiary care services for children. The hospital is the national centre for many services, including cardiac surgery, haematology, oncology, major burns, medical genetics, and medical research for childhood illnesses. Annually, the hospital treats over 24,500 inpatients, 76,000 outpatients and 30,100 emergency department attendances, and more than 13,500 operations are performed.<sup>7</sup> The Extracorporeal Life Centre (ELC) was established in 2005, and supports post-operative cardiac patients who have come off bypass and the recovery of patients with cardiomyopathy. OLCHC was recently made a Centre of Excellence for services provided by the ELC.

The physiotherapy department in OLCHC employs 18 physiotherapists, who work in a variety of highly specialised areas, such as respiratory medicine, cardiology, neurology, the transitional care unit, burns and plastics, and rheumatology. They liaise closely with the rest of the multidisciplinary team (MDT) in both of the intensive care units in the hospital – one with eight beds and the other with 12. Specialised physiotherapists work with patients with CF, both as inpatients and outpatients. The medical tower, which was opened in 2005 and contains two dedicated physiotherapy rooms, caters for many outpatient clinics, including the CF clinic. In OLCHC, two CF clinics are held weekly that can accommodate approximately 12 patients at a time. Each week, four annual patient reviews are also held to assess physical function and management, and to implement any new changes in therapy or treatment. A drop-in outpatient service is also available for CF patients on weekdays. These services play an essential role in the care and management of CF.

### **Cystic fibrosis**

CF is a genetic, chronic inflammatory disease that commonly presents with recurrent respiratory infection and malnutrition.<sup>8</sup> A mutation in the gene of the cystic fibrosis transmembrane conductance regulator (CFTR) protein causes this disease, a protein that is necessary for the regulation of the production of mucus, digestive juices and sweat. A multisystem disease, CF typically affects the gastrointestinal, endocrine and respiratory systems, but a number of other systems in the body can be included in the presentation (**Figure 1**). Impaired water and ion transfer across the epithelial surfaces of the body causes malabsorption in the GI tract and insufficiency of the pancreas. Mucus in the lungs becomes viscous, and neutrophils may further thicken the secretions. CF occurs in almost all ethnic groups, but is the most common autosomal recessive disease in Caucasians.

With a carrier frequency of one in 25.9,<sup>10</sup> Ireland has the highest incidence of CF worldwide, with one in 1,461 of the population affected.<sup>9</sup> Each year in Ireland, 30 to 40 children are diagnosed with this lethal condition. Despite the vast improvements made in the prognosis and management of CF, the current median age of survival is approximately 40 years.<sup>11,12</sup> Chronic respiratory disease results from prolonged bronchial obstruction, infection, inflammation and bronchiectasis, all of which lead to permanent lung damage. In younger patients, considerable damage may be present before airflow resistance is increased and a decreased flow can be measured.<sup>3</sup> Most patients die from chronic respiratory failure and, as there is currently no cure, their management incorporates medical treatment and respiratory physiotherapy techniques that aim to improve quality of life and extend survival.<sup>8</sup> Therefore, a comprehensive healthcare service is essential to provide these patients with the care and management they require throughout their lives. Ireland has not yet instituted newborn screening for CF, but this service is expected to commence in the first half of 2011. As a result, the majority of patients are diagnosed on presentation of their symptoms. Since the cornerstone of CF treatment is symptomatic management, physiotherapy plays an essential role. The presentation of CF is highly variable and individual to each patient, so it is accepted that no predetermined physiotherapy regime is applicable to all patients.<sup>3</sup> The implementation of a successful physiotherapy programme depends on comprehensive knowledge of respiratory anatomy and physiology, the goals of modern-day CF management, and a thorough overview and understanding of evidence-based practice regarding physiotherapy techniques.<sup>3</sup> "Good physiotherapy is the mainstay of clinical wellbeing in CF," since physiotherapy aims to slow progression of lung disease and optimise physical function and quality of life.<sup>3,13</sup>

### **Physiotherapy management of cystic fibrosis**

Daily physiotherapy management is implemented in the treatment of CF to ensure adequate ventilation of the lungs and

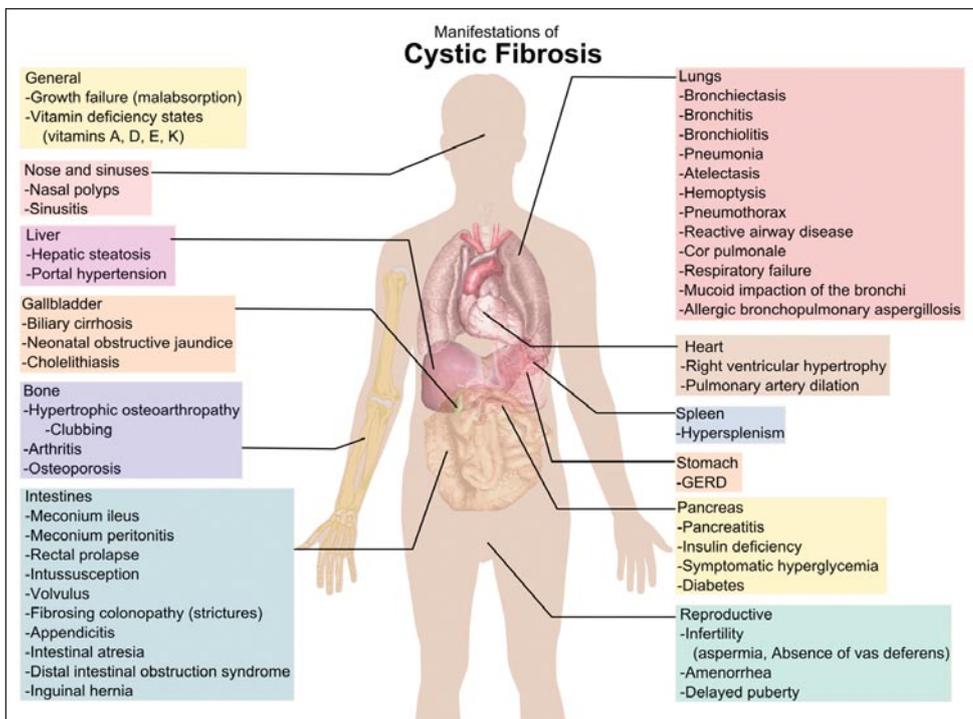


FIGURE 1: Diagram depicting the manifestations of cystic fibrosis. (Courtesy: Kliegman R; Source: Kliegman RM. Nelson Essentials of Pediatrics. St. Louis, Elsevier Saunders, 2006.)

to minimise lung damage secondary to impaired mucociliary clearance. The focus of treatment is prevention of lung deterioration and the incorporation of the physiotherapy principles of airway clearance and exercise into everyday life. A number of methods are utilised by Irish physiotherapists in the treatment of CF.

### The active cycle of breathing technique

The active cycle of breathing technique (ACBT) is comprised of three techniques, which mobilise and clear excess bronchial secretions.<sup>14</sup> The cycle begins with a period of breathing control, which reduces bronchoconstriction and aims to relax the patient. Thoracic expansion exercises then follow, which reduce resistance to airflow through the collateral channels of ventilation.

An inspiratory hold at the end of thoracic expansion allows for air to flow slowly into the diseased and healthy areas of the lung for equal ventilation.<sup>14,15</sup> The final stage of ACBT is the forced expiration technique (FET), which involves huffing at both low and high volumes to mobilise secretions from small peripheral airways into large, central airways.<sup>14,16</sup> The technique should be performed while seated, and cycle repetitions can be adjusted to suit the needs and requirements of the patient.<sup>15</sup> This effective method of secretion mobilisation should be performed independently when appropriate and utilised by the patient when necessary.<sup>14,15,16,17</sup>

### Positive expiratory pressure

Positive expiratory pressure (PEP) utilises end-expiratory resistance to mobilise secretions from closed or blocked

peripheral airways.<sup>14,18</sup> A face mask that incorporates a one-way valve, resistor and manometer is held tightly to the face, with the patient sitting down and leaning forward, elbows resting on a table. A cycle of 12-15 breaths is performed, using active tidal volume breaths that give a pressure reading of 10-20cmH<sub>2</sub>O mid-expiration.<sup>14</sup> A cycle of FET is then performed to clear mobilised secretions, and the cycle may be repeated depending on patient requirements. Accurate instruction as to the correct performance of the technique is essential to ensure optimal effect.<sup>14,18,19</sup>

### Postural drainage

Postural drainage and percussion techniques were initially introduced in CF management in the 1950s.<sup>14</sup> Despite having been replaced by less time-consuming and more lifestyle-friendly methods of secretion clearance, they still play an important role in CF management. Postural drainage is achieved by placing the patients in between six and 12 positions, depending on the lobe or lung segment affected, to enable gravity to influence secretion clearance.<sup>14</sup>

Chest percussion is then performed for three to ten minutes while the patient maintains this position. Deep breathing exercises can also be incorporated into the treatment, along with the vibration method of manual clearance and FET.<sup>14</sup> Adherence to postural drainage is generally poor, and the risk of aspiration following head-down positioning has led to a modification of drainage positions.<sup>20,21</sup> The implementation of postural drainage in a CF management programme is generally only advised for very young children when other modern methods of secretion clearance are unsuitable.<sup>21</sup>

### Autogenic drainage

Autogenic drainage involves the modulation of inspiratory and expiratory flow to create shearing forces that clear secretions from the bronchi.<sup>14</sup> A low-velocity inspiration is followed by exhalation, in which optimal shearing forces are localised to the site of secretion and accumulation within the lungs. Upper airways are cleared first, followed by the peripheral airways.<sup>14</sup> Assisted autogenic drainage is utilised in very young or non-compliant patients.<sup>14</sup> The functional breathing level of the patient is modulated manually or by elastic straps in order to obtain optimal airflow velocity, which can be targeted at specific secretions. The child's abdominal wall must be stabilised to prevent paradoxical movements. Assisted autogenic drainage can be combined with gentle bouncing on a physiotherapy ball, which may aid in relaxation and optimisation of expiratory air flow.<sup>14,22</sup>

### Oscillatory positive expiratory pressure

Oscillatory positive expiratory pressure (PEP) is utilised in devices such as the Flutter or the Acapella. The Flutter device facilitates mucociliary clearance by inhibiting premature closure of the bronchi.<sup>14</sup> FET is used post treatment to facilitate expectoration. On exhalation through the Flutter, the bronchi undergo a series of vibrations that are combined with PEP (18-35cmH<sub>2</sub>O) and variations in endobronchial pressure.<sup>14</sup> The spatial position of the device relative to gravity determines the oscillation frequency. The Acapella, on the other hand, is not gravity-dependent and may prove easier for certain patients to use at low-velocity expiration.<sup>14</sup> With the patient sitting comfortably, the mouth must form a tight seal around the device. The patient inhales through the nose and, following a brief inspiratory hold, exhales maximally. A cycle of 10-15 breaths is performed through the device, followed once again by FET.<sup>14</sup> Although further research is required to determine the efficacy of the Flutter as a method of secretion clearance compared to other interventions, current best practice dictates its incorporation into a varied physiotherapy regime rather than its standalone use.<sup>14</sup> Based on information gathered by the Cystic Fibrosis Registry of Ireland in 2007, the most popular physiotherapy modalities used by Irish CF patients are PEP, the Acapella device, percussion techniques and regular exercise.<sup>23</sup>

Mucociliary clearance and defence against infection are limited in CF due to abnormal airway surface liquid. This results in a continuous cycle of chronic inflammation, infection, excess mucus and airway obstruction, which culminates in irreversible bronchiectasis. As a result, airway clearance techniques have historically formed the foundation for the physiotherapy treatment of CF. A systematic review conducted by Van der Schans *et al.* concluded that chest physiotherapy is effective in the short-term treatment and management of CF.<sup>24</sup> However, definitive research comparing the efficacy of the different clearance modalities is missing from the literature because of a lack of appropriate outcome measures, control groups and subjects. Meta-analyses have concluded that there is little difference between the various methods, but that patient preference points towards the self-administered methods of airway clearance.<sup>19,25</sup> Patient preference is an important element to consider since adherence rates to physiotherapy treatment in CF are estimated at less than 50%.<sup>27</sup>

### Exercise

Exercise is also encouraged in the physiotherapy management of CF, with approximately 36% of patients incorporating it regularly into their treatment regimes.<sup>23</sup> Exercise tolerance may be severely limited in CF, since dyspnoea and an abnormal ventilatory response to physical activity are a consequence of the progressive nature of the respiratory disease.<sup>27</sup> However, participation in a tailored exercise programme can result in improved appetite, body image, pulmonary function, feelings of wellbeing, and work and sport performance. Exercise can also have beneficial effects on anxiety, depression and the development of osteoporosis.<sup>27,28,29,30</sup> Future research is required to focus on the duration and type of exercise programmes that will deliver the most benefit, especially for paediatric patients.

At OLCHC, patients are encouraged to participate in a wide variety of exercises, both at home and in school, a suggestion based on studies that have indicated that children prefer exercise to other forms of treatment.<sup>31</sup> Irish paediatric physiotherapists also focus on the management and maintenance of posture in CF patients. Evidence suggests that compromise of the respiratory system can have a detrimental effect on the control of postural trunk muscles, which can thereafter impede growth, development and normal movement.<sup>32,33</sup>

Pain is a commonly reported symptom in CF, resulting from poor bone mineral density, postural adaptations, coughing and osteoporotic fractures.<sup>33</sup> Pain is detrimental to core muscle control and can lead to the development of trunk deformities, such as thoracic kyphosis.<sup>33</sup> The subsequent development of poor posture, musculoskeletal deformity and tissue contractures can have an adverse effect on respiratory function and hastens the progression of chronic respiratory deterioration.<sup>33</sup> Therefore, advice and musculoskeletal techniques provided by the physiotherapist in the management of posture is essential for the growth and development of the CF patient.

### Conclusion

The role of the paediatric physiotherapist in Ireland is both diverse and demanding. A variety of skills is required to meet the needs of this patient group and assist in their development and growth. The encouragement, education and inclusion of parents and carers are vital to ensure optimal management of the child. The physiotherapists working at OLCHC display all these attributes and capabilities.

Despite the demanding environments in which they work, these physiotherapists promote positive and nurturing atmospheres, combining their specialised skills with a dedication to meeting the needs of their patients.

The role of the paediatric physiotherapist in Ireland will continue to evolve, especially as further comprehensive research is required to consolidate evidence-based practice and determine optimal treatment approaches. The future for paediatric

physiotherapy is exciting and opportunities for research, learning and development are numerous, with Irish physiotherapists leading the way in providing comprehensive and innovative care for their patients.

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