

PAEDIATRIC RESPIRATORY DISTRESS: AN OVERVIEW

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SUMMARY

A clinical framework within which to investigate paediatric patients referred for respiratory physiotherapy is presented. The role of the physiotherapist in the management of these patients is discussed.

It is possible, although not desirable, for physiotherapists to successfully treat some symptoms while not knowing their cause. This does not apply when dealing with respiratory distress in infancy and childhood, where the cause must be identified if the distress is to be reversed.

INTRODUCTION

Bennion in 1969 spoke of masseurs and other medical auxiliaries whose "attributes of dependency clearly militate against this (professional) status".¹ Campbell on the other hand, in 1980, conceded that "the practice of physiotherapy is a vocation which has shifted from occupation to profession".²

While it is gratifying to note this shift in perception and to appreciate that in certain areas we are regarded as the undisputed experts, there are still instances when we act with less than professionalism and still demonstrate "attributes of dependency". There are still, for example, doctors who regard physiotherapy as the universal panacea for any aberration in ventilatory function, and there are still physiotherapists who treat all patients referred for chest physiotherapy simply because they have been referred.

We denigrate our standing as independent practitioners unless we commit ourselves to the pursuit of excellence in the practice of our profession. It is imperative that we be able to assess accurately in order to decide whether physiotherapy will be of benefit or not, and that our judgement be accepted by fellow members of the health care team. Automatic response to a diagnosis like pneumonia or a symptom like wheezing without careful assessment, is not in the interests of optimal patient care. This article is intended to provide a simple clinical framework within which to view paediatric respiratory distress and the responsibility of the physiotherapist referred such patients.

CONCEPTS RELATING TO RESPIRATORY DISTRESS

i) Simplistically speaking, the respiratory system may be

OPSOMMING

'n Kliniese raamwerk word aangebied waarvolgens pediatriese pasiënte, wat vir respiratoriese fisioterapie verwys is, ondersoek kan word. Die rol van die fisioterapeut in die hantering van hierdie pasiënte word bespreek.

regarded as having three main components -

- the control system
- the ventilating "pump" and
- the airway.

ii) Pathology in either the control system or the "pump" will result in a degree of respiratory failure. The child is unable to move air in and out of the lung adequately, and some degree of assistance will be required. (Respiratory failure will not be discussed in this article.)

iii) Pathology in the airway, on the other hand, will cause respiratory distress. The effect is one of an increase in the work of breathing, the child employing several devices in an effort to move air against the obstruction. It is important to remember that obstruction of the airway will initially cause respiratory distress. If it is severe enough, or if it is allowed to continue unrelieved for long enough, distress will proceed to failure.

PAEDIATRIC RESPIRATORY DISTRESS

Respiratory distress is a common entity in the paediatric age-group. The consequences of even mild reduction in airway diameter are much more dramatic in children than in adults.

The explanation for this is as follows:-

- paediatric airways are small and the total resistance increases by the fourth power of any reduction in radius;
- the small peripheral airways in the infant lung may contribute as much as 50% to total airway resistance, this contribution being only 20% in the adult lung;³
- the cartilaginous support of infant airways is poor.

Delineation of the airway

The airway begins at the external nares and ends at the blood/gas interface. It is broadly divided into the upper and lower airway, the former being extrathoracic and the latter intrathoracic.

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SIGNS OF PAEDIATRIC RESPIRATORY DISTRESS

- tachypnoea – being the child's attempt to improve minute ventilation
- recession (suprasternal, intercostal and subcostal) – reflecting both the increased inspiratory effect and the compliance of the infant chest wall
- use of accessory muscles of respiration
- nasal flaring
- cyanosis/oxygen requirement.

These are the signs of an obstructed airway. The site of the obstruction, whether in the upper or lower airway, can be either -

- luminal (eg smooth muscle spasm or oedema)
- intraluminal (eg secretions or a foreign body)
- extraluminal (eg a vascular ring).

SOUNDS OF RESPIRATORY DISTRESS

The most important sounds of obstructed airflow are those of stridor and wheezing. It is the sound which locates the obstruction to either the upper or lower division.

Wheezing is a musical sound heard mainly during expiration and caused by lower airway obstruction. Stridor is an inspiratory sound, harsh in character and indicative of pathology in the upper airway.

Measurements of the changes in airway calibre during breathing indicate that the intrathoracic airways dilate during inspiration and narrow during expiration, and that the converse changes occur in the extrathoracic airway. There is therefore more resistance to airflow during expiration in the lower airway, and during inspiration in the upper airway under normal physiological conditions.⁴ It follows that obstruction of the lower airway will be reflected during the expiratory phase, while that of the upper airway will be reflected during the inspiratory phase.

Severe obstruction in either division will be reflected during both phases, and a silent chest in the presence of other signs of obstruction is evidence of minimal airflow.

UPPER AIRWAYS OBSTRUCTION

- i) Causes
- ii) Grading of severity
- iii) Principles of management

i) The common causes of stridor in childhood are -

- acute laryngotracheobronchitis (croup)
- foreign bodies
- congenital subglottic stenosis
- acute epiglottitis (a medical emergency)
- juvenile laryngeal papillomatosis

ii) Upper airway obstruction can be progressive and potentially life-threatening, with hypoxic sequelae and death the possible consequence. Accurate and early diagnosis, together with careful monitoring of the severity of the obstruction, are essential if significant morbidity and mortality are to be prevented.

The severity of upper airway obstruction has been classified as follows at the Red Cross War Memorial Children's Hospital.⁵

Grade I: inspiratory obstruction with inspiratory stridor or retractions.

Grade II: inspiratory obstruction + passive expiratory obstruction.

Grade III: inspiratory + active expiratory obstruction and palpable pulsus paradoxus.

Grade IV: as in Grade III + marked retractions, apathy and cyanosis.

Expiratory obstruction is characterised by prolonged expiration. In active expiration there is visible or palpable contraction of the abdominal muscles. When palpable, pulsus paradoxus is over 20 mmHg.

iii) The medical management of upper airway obstruction follows an ordered sequence -

- removal of cause if possible
- relief of obstruction
 - mild: extra humidification
 - moderate: nebulised adrenaline
 - severe: artificial airway.

LOWER AIRWAY OBSTRUCTION

- i) spectrum of causes
- ii) principles of management

i) Except for acute and sustained hyper-reactive disease (status asthmaticus), obstruction of the lower airway does not pose the same immediate threat to the child as obstruction of the upper airway may do. Consequently, the clinical emphasis is placed more on the identification of the cause.

"All that wheezes is not asthma" – Chevalier Jackson.³

While asthma is indeed the commonest cause of wheezing in the paediatric, if not the neonatal age-group, it is not the only cause.

The following is a list of conditions causing wheezing seen in the Paediatric Department of the Johannesburg Hospital between 1979 and 1986.

- asthma
- infection
 - bronchitis/bronchiolitis/pneumonia
- chronic lung disease
 - bronchopulmonary dysplasia
 - cystic fibrosis
- aspiration syndromes
 - abnormal enteropulmonary connection H-fistula
 - gastro-oesophageal reflux
 - inco-ordinated swallowing
 - poor infant feeding practices
- airway compression
 - abnormal vessels
 - vascular ring / truncus arteriosus
- airway stenosis
 - post-extubation / congenital
- airway hypoplasia
 - congenital
- floppy airways disease
 - tracheomalacia/bronchomalacia
- foreign body
 - in airway / in oesophagus
- congenital heart disease
 - peri-airway oedema / pulmonary oedema

- primary ciliary abnormalities
 - Kartagener's disease
- ii) Effective management of lower airway obstruction will depend on accurate diagnosis of the cause of the obstruction. This will dictate the nature of the intervention, which could be either medical, surgical, physiotherapeutic or a combination.

CHEST PHYSIOTHERAPY

Chest physiotherapy includes inhalation therapy and chest clearance techniques. It is indicated in any condition in which an excess of pulmonary secretions cannot be moved by such normal clearance mechanisms as ciliary activity and voluntary coughing. We can only deliver nebulised bronchodilators/mucolytics or antibiotics, and we can move and eliminate secretions, tenacious or otherwise. It follows that physiotherapy for the relief of airway obstruction is ineffective unless the obstruction is being caused by either bronchial smooth muscle constriction and/or accumulated secretions.

RESPONSIBILITY OF THE PHYSIOTHERAPIST

The responsibility of the physiotherapist working with paediatric patients referred for chest physiotherapy is simple.

He/she should be able to -

- detect the presence of respiratory distress
- locate it to the upper or lower airway
- grade the clinical severity
- assess the need for physiotherapy.

CONCLUSION

The credibility of our profession, as we enter the last decade of the twentieth century, will depend on many factors. Not the least of these will be our ability to distinguish between those patients who will indeed benefit from physiotherapeutic intervention, and those who will not. This demands a broadening of our knowledge base, an improved application of basic scientific principles and the development of more accurate clinical observational skills.

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