

## Review

## Breathing abnormalities in children with breathlessness

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## EDUCATIONAL AIMS

THE READER WILL BECOME MORE FAMILIAR WITH:

- What is known of the prevalence of dysfunctional breathing in children.
- The clinical presentation and diagnosis of dysfunctional breathing.
- The possible treatment of dysfunctional breathing.
- The long term outcome of dysfunctional breathing.

## ARTICLE INFO

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## SUMMARY

Dysfunctional breathing, hyperventilation and vocal cord dysfunction are frequently seen in children and adults. The prevalence is unknown. There are no standardized diagnostic criteria, and for now, effective exclusion of organic disease leaves the diagnosis of dysfunctional breathing. Therapy is mainly focussed on explanation of a benign condition and reassurance. Since dysfunctional breathing is a possible chronic condition, other therapies should be evaluated. In adults physiotherapy and breathing retraining appear beneficial. In childhood there is lack of evidence, and further research is necessary in order to optimise the outcome for children with dysfunctional breathing.

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## INTRODUCTION

Breathlessness is the subjective sensation of difficult, laboured or uncomfortable breathing.<sup>1</sup> In normal circumstances breathlessness is physiological when exercising beyond normal tolerance but pathologically when breathlessness occurs with little or no exertion.

Breathlessness is a key feature of pulmonary disease in children. The causes of breathing disorders vary. They include: asthma, rhinitis, emphysema, cystic fibrosis, interstitial lung disease and less frequent pulmonary disorders.<sup>2</sup> In these pulmonary diseases the aim of the therapy is to treat and prevent breathlessness or dyspnoea. When experiencing breathlessness it is always almost associated with anxiety and, when chronic, can be disabling and severely diminish quality of life.<sup>3</sup> Because there are no standardized criteria for the diagnosis dysfunctional breathing and the

prevalence is unknown, the diagnosis is considered when other causes are excluded.<sup>4</sup>

In the absence of a pulmonary disease symptomatic breathlessness can occur. In this review the focus will be on breathlessness without distinct pulmonary disease. In breathing abnormalities in children with breathlessness with the absence of a pulmonary disease the diagnosis dysfunctional breathing should be considered. Dysfunctional breathing, including hyperventilation and vocal cord dysfunction, can cause breathlessness.<sup>5</sup>

This review will specifically consider:

- The prevalence of dysfunctional breathing in children.
- Clinical presentation and diagnosis.
- Treatment of dysfunctional breathing.
- Long term outcome.

## METHODS

Studies were identified in Pubmed, EMBASE and the Cochrane Library. The keywords “breathing abnormalities”, “breathless-

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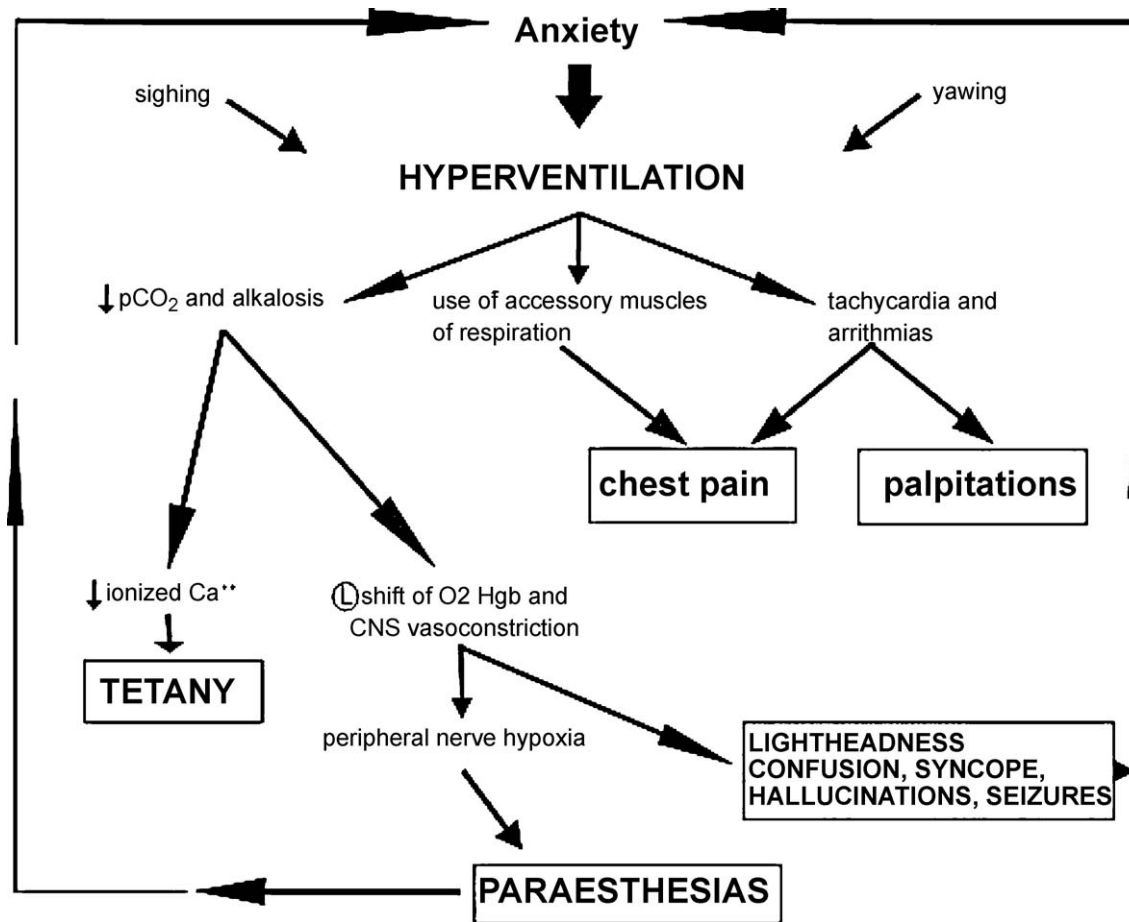


Figure 1. Pathophysiologic mechanism of hyperventilation.(adapted from Herman *et al.*)<sup>17</sup>

ness”, “dyspnoea”, “dysfunctional breathing”, “vocal cord dysfunction”, “hyperventilation”, “anxiety”, “treatment” and “diagnosis” were used. The search was limited to “all child”. The references in retrieved articles were scanned to find additional relevant papers.

#### DEFINITION OF BREATHING ABNORMALITIES

Dysfunctional breathing [DB] is defined as chronic or recurrent changes in breathing pattern, causing respiratory and non-respiratory complaints.<sup>6</sup> Symptoms of DB include dyspnoea with normal lung function, chest tightness, chest pain, deep sighing, exercise induced breathlessness, frequent yawning and hyperventilation.<sup>7,8</sup>

#### Hyperventilation

Acute hyperventilation is the physiologic state of over-breathing in which breathing is occurring in excess of metabolic requirements, leading to an acute reduction in PaCO<sub>2</sub> and the consistent set of physiologic changes that occur in response to this state.(Figure 1)<sup>9</sup> This can be done voluntarily, but in most cases it overwhelms the patient, especially when symptoms are mimicking serious illnesses. The symptoms are chest pain, breathlessness, dizziness, tachycardia, dry throat, swallowing difficulty, tremors and sweating.<sup>10</sup> Other symptoms are associated with hyperventilation syndrome and are listed in Table 1.

#### Vocal cord dysfunction

Vocal cord dysfunction (VCD) syndrome is a functional disorder of the vocal cords,<sup>5</sup> characterized by the inappropriate adduction of

the vocal cords during inspiration. The clinical features of VCD are dyspnoea, cough, wheeze or stridor, choking and complaints of chest or throat tightness.<sup>11</sup> Two phenotypes of vocal cord dysfunction syndrome have been described.<sup>12</sup> One type occurs spontaneously, with the patient experiencing dyspnoea and inspiratory stridor (often described as “wheezing”) at various and often unpredictable times. This is symptomatic vocal cord dysfunction (SVCD) The other phenotype only occurs with exercise, and is therefore called exercise induced vocal cord dysfunction(EIVCD)<sup>12</sup>.

#### EPIDEMIOLOGY OF BREATHING ABNORMALITIES

Hyperventilation syndrome (HVS) is common in adults. The frequency in the general population is between 6% and 10%.<sup>13,14</sup> In a semirural general practice adult population 8% of the patients without previous, or current asthma showed positive screening for hyperventilation using the Nijmegen questionnaire [Table 2].<sup>15</sup> Dysfunctional breathing was more prevalent in women (14%) than in men (2%).

The prevalence of HVS or DB in the paediatric population is unknown. Enzer *et al.* [1967] studied 44 cases of paediatric hyperventilation. They reported a prevalence of the hyperventilation syndrome in females compared with boys. (70% vs 30%)<sup>16</sup> The age of onset and sex distribution of these cases are shown in Figure 2. In children identified in the Mayo clinic with hyperventilation in the period 1950-1975 (n = 34) the greatest number of cases (n = 18) occurred in the 13-15 year old children.<sup>17</sup> They did not find a difference between boys and girls. In children evaluated for exercise induced asthma in Vancouver, Canada in 26.9% of the

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