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Review article

The presence of respiratory disorders in individuals with low back pain: A systematic review

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ABSTRACT

Background: Inspiratory muscles, such as the diaphragm, play a key role in both respiration and spinal control. Therefore, diaphragm dysfunctions are often related to low back pain (LBP). However, few is known on the association between the presence of LBP and the presence of respiratory disorders (RD).
Objectives: To perform a systematic review on the relation between RD and LBP.
Study design: Systematic review.
Methods: Two reviewers searched on PubMed/MEDLINE for studies concerning LBP and RD, from 1950 up to January 2016. The search string consisted of the following key words: *low back pain, dyspnea, respiratory problems, lung diseases, comorbidity, pulmonary disease, chronic obstructive, smoking, asthma, allergy, sinusitis, respiratory tract infection* and *hyperventilation*. The aim was to evaluate a potential correlation, co-occurrence or causality between RD and LBP.
Results: A total of 16 articles were included. A significant correlation between the presence of LBP and the presence of RD such as dyspnea, asthma, different forms of allergy, and respiratory infections was found. No correlation was found between Chronic Obstructive Pulmonary Disease (COPD) and LBP, and no articles were found on the correlation between hyperventilation and LBP.
Conclusions: This is the first study providing an overview of the literature on the relation between LBP and RD. Immunological, biomechanical, psychosocial and socio-economic factors might explain this correlation. Smoking is likely to contribute. Future studies must reveal the causative relationship.
Level of evidence: Therapy, level 2a.

1. Introduction

Low back pain (LBP) is worldwide one of the most important medical conditions in terms of reduced quality of life, disability and socio-economic costs. LBP has a life-time prevalence of 84%. About 10% of all patients with an acute episode of LBP develop chronic LBP (i.e. lasting longer than 3 months). LBP affects men and women equally. The prevalence peaks between 35 and 55 years old and has a complex etiopathogenesis with multiple intrinsic and extrinsic risk factors (Balagué et al., 2012).

Decreased postural control appears to be associated with the presence of LBP (Ruhe et al., 2011). Although the causal link is not fully clear yet, it is known that dominant use of ankle proprioception during postural control relates to the development and recurrence of LBP (Claeys et al., 2015). The inspiratory muscles (IM), and specifically the diaphragm, have a key role in controlling the spine, which is crucial during postural control (Hodges and Gandevia, 2000). However, during loading of the IM, the use of back proprioceptive signals, necessary for balance control, is reduced in individuals with LBP (Janssens et al., 2010) and in

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patients with Chronic Obstructive Pulmonary Disease (COPD) (Janssens et al., 2013b). Furthermore, individuals with LBP showed greater susceptibility to diaphragm fatigue compared to healthy controls (Janssens et al., 2013a). Recently, this research group found that targeted training of the IM in individuals with LBP improved postural control and significantly lowered the severity of LBP (Janssens et al., 2015).

Respiratory muscle weakness and diaphragm fatigue are also found in some patients with COPD during high-intensity exercise (Decramer et al., 1980; Polkey et al., 1996; Bachasson et al., 2013). Patients with more hyperinflation during exercise showed greater diaphragm fatigue. The latter can be explained by diaphragm flattening and thus an impaired pressure-generating capacity, resulting in a limited contribution of the diaphragm to IM work (McKenzie et al., 2009). Likewise, exacerbations of asthma, airway closure and expiratory airflow limitation can result in hyperinflation. This in turn, compromises the stabilizing function of the diaphragm (Hill, 1991).

Important questions that arise are whether and, if so, to what extent, patients with LBP are susceptible to having a respiratory disorder (RD) and vice versa. To the best of our knowledge, this is the first systematic review providing an overview of the literature on the relation between the presence of RD and the presence of LBP. If there is indeed a correlation, further research must reveal if IM training can be a valuable tool in the rehabilitation of specific subpopulations of individuals with LBP.

2. Material and methods

2.1. Literature search strategy

A computerized search in the PubMed/MEDLINE database was conducted independently by two reviewers (A.V. and N.B.) from 1950 up to January 2016. The search string consisted of combinations of the following key words and Medical Subject Headings (MeSH): *low back pain [Mesh], dyspnea [Mesh], respiratory problems, lung diseases [Mesh], comorbidity [Mesh], pulmonary disease, chronic obstructive [Mesh], smoking [Mesh], asthma [Mesh], allergy, sinusitis [Mesh], respiratory tract infection [Mesh]* and *hyperventilation [Mesh]*. After the computerized search, reference lists of all selected articles were manually checked for additional relevant articles. After de-duplication, the two reviewers independently screened each article to select the potentially relevant studies from titles, abstracts, and keywords. If any of the inclusion criteria were not met, the article was excluded from further consideration. Remaining articles were then screened based on full-text.

2.2. Eligibility criteria for considering studies for this review

Eligibility assessment of the obtained articles was performed independently by the two reviewers (A.V. and N.B) by screening the articles based on predefined in- and exclusion criteria.

2.2.1. Eligibility criteria for types of study

The following criteria were used to exclude articles from further consideration: published prior to 1950, not written in Dutch or English, did not include human data, contained no original data, abstract or conference proceeding, no full text available, or article not meeting the topic.

2.2.2. Eligibility criteria for types of participants

Study participants had to be female and male adults of at least 18 years old, who reported or had been diagnosed with any type of LBP and any type of RD.

2.2.3. Eligibility criteria for outcomes

To be included, articles had to investigate a relation, co-occurrence or causality between LBP and RD.

2.3. Risk of bias in included studies

Risk of bias of all included studies was assessed independently by two reviewers (A.V. and N.B.) by using the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement for cohort case-control and cross-sectional studies (von Elm et al., 2008). We used the principles from the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) working group to summarize the body of evidence overall. It was judged that the data were not suitable for statistical pooling due to the heterogeneity of the study designs. Therefore, the results were summarized qualitatively. Disagreements were resolved through consensus with other authors.

2.4. Data collection and analysis

After the initial assessment for eligibility, the two reviewers independently extracted the following data from the included studies: study design, sample size, sex, age, type of LBP, type of RD, and main study result.

3. Results

A flowchart of the literature search is shown in Fig. 1. A total of 16 articles were included. The results of the quality assessment of each study are shown in Table 1. Study results are presented in Table 2. One article described the relation between LBP and dyspnea, six articles investigated the relation of LBP with non-specified

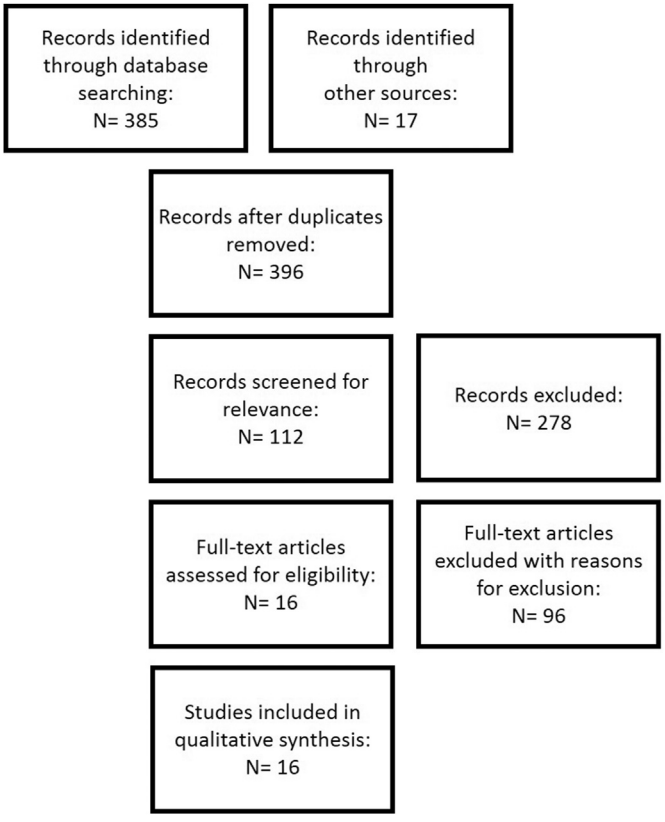

Fig. 1. PRISMA flow chart of study-selection process.