

PSYCHOPHYSIOLOGY OF RESPIRATORY DISEASE: CLINICAL CONSIDERATIONS FOR THE ADVANCED PRACTICE NURSE

Sarah Miller¹, Laura Owens¹, Tracy Collins¹, Erin Silverman²

¹University of Memphis, Loewenberg School of Nursing, Memphis, TN, USA

²University of Florida, Department of Physiological Sciences, Gainesville, FL, USA

Abstract. The purpose of this article is to describe the psychophysiology of dyspnea in chronic obstructive pulmonary disease (COPD), identify the unique impact of respiratory disease on the female patient, and discuss the relationship of anxiety and depression in disease manifestation. Current COPD assessment and treatment guidelines published by the United States Department of Health and Human Services, the World Health Organization as well as the National Institute for Health and Care Experience (NICE) will be presented along with implications for the Advanced Practice Nurse (APN). Practitioners treat COPD patients with advanced physiological complications along with psychological comorbidities that worsen the disease perception and progression. Therefore, a recommendation will be made to integrate assessment and evaluation of psychological comorbidities in COPD patients, with particular consideration given to the female patient. Utilizing a holistic, integrated treatment plan will serve to enhance patient care, alleviate disease burden and impact overall quality of life in the patient with COPD.

Keywords chronic obstructive pulmonary disease (COPD), dyspnea, psychophysiology, depression, anxiety, gender

1 Introduction

Chronic respiratory diseases, such as chronic obstructive pulmonary disease (COPD), are the third leading cause of death in America, behind heart disease and cancer (Centers for Disease Control and Prevention, United States Department of Health and Human Services (CDC), 2012). COPD is a term that refers to a large group of deteriorating respiratory diseases that interfere with breathing due to airway obstruction (American Lung Association (ALA), 2013a). COPD limits quality of life (QOL) by preventing or limiting every day activities such as working, activities requiring physical exertion, household chores and participation in family activities (ALA, 2013a). Consequently, individuals with COPD frequently report lower than normal health-related QOL, while also demonstrating increased levels of anxiety and depression (Arne et al., 2009), along with decreased capacity for exercise,

decreased physical activity levels and non-completion of self-care activities of daily living (ADLs) (Pitta et al., 2006). HRQoL encompasses the more subjective influence of the disease on the quality of life and how overall QOL in turn affects personal mental and physical health (Ketelaars et al., 1996; CDC, 2000). The deleterious effects of COPD on QOL can be partially attributed to the associated sensation of difficulty breathing, or dyspnea (Burgel et al., 2013). Dyspnea has been rated as one of the most significant contributors to diminished HRQoL in patients with COPD (Nishimura et al., 2008).

This article utilizes available psychophysiological evidence to provide Advanced Practice Nurses (APNs) an overview of the need for assessment of psychological comorbidities in patients with chronic obstructive pulmonary disease (COPD) in order to better manage patient outcomes and improve quality of life. Further, this article will describe the role dyspnea plays in perception of health-related quality of life (HRQoL), the unique psychological comorbidities often noted in female COPD patients, current practice guidelines related to COPD care, and implications for the Advanced Practice Nurse (APN).

2 Dyspnea

To fully examine the effects of dyspnea on the patient, it is first necessary to understand the neurological processing of negative (aversive) respiratory sensations. During a COPD exacerbation, the respiratory system is presented with a 'load' that disrupts normal bodily homeostasis and must be physically overcome or adapted to. An example of a respiratory load is an increase in lower airway resistance, accumulation of mucus, or bronchial spasms. There are two primary cognitive components to the perception of increased respiratory loads: discriminative and affective (Davenport & Vovk, 2009). Initially, the brain discriminates the respiratory sensation through a complex interaction among multiple respiratory afferent groups and brainstem centers that control respiratory motor drive (Davenport & Vovk, 2009). This is the somatosensory event related to cognitive awareness of breathing disruption.

During the following affective phase, the individual qualifies how he or she feels as a result of the aversive respiratory event and if the sensation is unpleasant. In experimental settings, subjects seldom report unpleasant evaluations of short or single breath loads, but this changes with persistent dyspnea and results in increases in unpleasant affective evaluation (Alexander-Miller & Davenport, 2010). Extremely large resistive loads have been shown to induce fear of suffocation and increased discomfort (Pappens, Smets, Van den Bergh & Van Diest, 2012b). The nature of this affective phase is highly variable across individuals.

Correspondence to: Sarah Miller (smiller2@memphis.edu)

Received: 31.01.14 - Revised: 16.03.14 - Accepted: 22.03.14 -

Published: 24.04.14

© 2014 The authors

Females tend to magnify their perception of extended respiratory loads (Alexander-Miller and Davenport, 2010), while highly anxious subjects have reduced respiratory sensory gating leading to altered perception (Chan et al., 2012).

Due to the progressive and chronic nature of COPD, patients often experience sustained, undesirable respiratory sensations that lead to discomfort and altered perception of their breathing. These sensations vary by individual, based upon gender, previous experiences, and levels of anxiety (Alexander-Miller & Davenport, 2010; Chan et al., 2012).

Individuals who report extreme “fear of suffocation” experience increased physical discomfort associated with dyspnea (Pappens et al., 2012a). These individuals tend to place greater strain on respiratory muscles by increasing ventilatory response to loads. This added physiological strain results in a mutual reinforcement of both fear and maladaptive breathing (Pappens et al., 2012b). Some individuals react with extreme fear to respiratory stimulation, such as increased carbon dioxide, which can trigger a hypersensitive fear network (Nardi, Freire & Zin, 2009; Sinha, Papp & Gorman, 2000). Studies have shown that COPD patients experience restricted ability to perform ADLs and this fear of dyspnea leads to avoidance of activities (Janssens et al., 2011; Mikkelsen et al., 2004; Ng et al., 2007; Yohannes, Baldwin & Connolly, 2000; Zoeckler et al., 2012; Zoeckler et al., 2014).

Essentially, individuals with chronic respiratory disease learn to fear disease exacerbations, specifically dyspnea (Janssens et al., 2011). This fear is self-potentiating and eventually becomes limiting as individuals avoid activities (such as social events, engaging in physical activity or ADLs, or even leaving their home), potentially contributing to further social isolation, physical deconditioning and reduced QOL (Thomas, Decramer & O'Donnell, 2013).

3 Psychological Comorbidities

Furthering the physiological detrimental effects and morbidity of chronic respiratory disease is the added burden of psychological comorbidities. Depression and anxiety are comorbidities frequently associated with COPD (Kunik et al., 2005), with prevalence estimates generally higher than other advanced chronic diseases (Maurer et al., 2008). These psychological comorbidities associated with COPD are often left untreated or under-treated (Cully et al., 2006), leading to decreased QOL, increased rates of hospitalization, and reductions in treatment adherence (Stapleton et al., 2005).

It is still unclear what the exact relationship direction is between depression and anxiety in COPD, but a recent study found that depression adversely affects COPD prognosis, resulting in increased exacerbation risk and possibly death (Atlantis et al., 2013). Management of depression and anxiety may improve QOL while increasing capacity for physical activity and treatment adherence (Stapleton et al., 2005; Light et al., 1985). COPD has also been shown to contribute to the emergence and exacerbation of psychiatric disorders such as depression and anxiety and may decrease treatment adherence by diverting cognitive resources (Turan, Yemez & Itil, 2013).

4 Unique impact on the female patient

Female COPD mortality has been on a steady rise and has quadrupled since 1980 (ALA, 2013b). Since 2000, COPD has claimed more female than male lives, with women making up 53% of COPD deaths (CDC, 2012). The impact of COPD on women in particular is understudied, despite evidence showing gender-based differences in treatment response (Haave, Skumlien & Hyland, 2008; Varkey, 2004).

COPD more adversely affects women than it does men, and women with COPD have higher levels of anxiety and depression (Di Marco et al. 2006). The quality of life for women is impacted earlier in life than their male counterparts with similar disease severity (de Torres et al., 2006; Naberan et al., 2012). This may be attributed to increases in subjective feelings of shortness of breath, which has a strong correlation for QOL (van Haren-Willems & Heijdra, 2010). Women show more variance in reports of symptom intensity (particularly dyspnea) than males with similar disease progression and also have lower exercise capacity (de Torres et al., 2006). An in-depth 2014 study by Raheison et al. found significant gender differences impacting the female patient, particularly from chronic sputum. Females reported lower QOL than men and were more impacted by chronic cough, despite lower GOLD-staged disease severity (Raheison et al., 2014). The Global Initiative for Chronic Obstructive Lung Disease (GOLD) provides evidence-based guidelines for assessment, diagnosis, management, diagnostic spirometry and staging criteria of airflow limitation in the severity of COPD (GOLD, 2014).

Women also feel that they experience diagnostic delays, have trouble reaching their physician, and believe their treatment time with a physician to be insufficient (Martinez et al., 2012). The delay in diagnosis for female patients can be credited to COPD being historically thought of as an “older white man’s disease.” Although the disease remains undiagnosed in women much longer than for men, COPD continues to develop rapidly in women and must be addressed in primary care. The ALA (2013b) called for “taking action” against rising COPD morbidity and mortality, encouraging healthcare providers to adopt practices and policies to improve diagnosis and screening of COPD in women.

5 Clinical COPD Guidelines

APNs use a process of diagnostic reasoning to assess, evaluate and recommend treatment for the patient. The four major concepts addressed in all current assessment guidelines are diagnosis, evaluation, management, and treatment. Together, each category enhances the other by integrating available patient evidence to facilitate optimal care by the provider while lessening the chance of misdiagnosis and biases. Considering the consequences of dyspnea on QOL and subsequent psychological effects, it is recommended that an early psychological evaluation including screening for anxiety and depression be assimilated into each of the four concepts of care. Raheison et al. (2014) recommend management of COPD should incorporate psychological distress and socioeconomic status, particularly in women who are unemployed and living alone, and consider the specific impact of chronic sputum in women.

The National Institute for Health and Care Experience (NICE) and GOLD have published professional guidelines for COPD assessment and coexisting comorbidities (NICE, 2014; GOLD, 2014). NICE guideline 91 highlights the importance of early identification of patients with a chronic health condition, such as COPD, who are at increased risk for depression and functional impairment (NICE, 2014). The guidelines address disease-associated mood fluctuations, loss of pleasure in activities, pain, functional impairment and disability that can increase the risk of depression and anxiety. Cote and Chapman (2009) report that psychiatric disorders such as depression are three times more common in women with COPD than in men with COPD. Women admit to these manifestations while reporting their chief complaint to a provider (Cote & Chapman, 2009). Therefore, assessing for anxiety and depression in women with COPD and implementing the standards set forth in the GOLD and NICE guidelines will enhance the quality of care provided by APNs for the female COPD patient.

6 Final Commentary

While clinical guidelines are well established to diagnose and treat COPD, practice guidelines target isolated diseases and do not encompass comorbidities, presenting a challenge in COPD care (Garcia-Olmos et al., 2013). Like many chronic diseases, COPD affects multiple aspects of the patient and varies by each patient. Vigilant review of clinical practice guidelines is necessary to optimize evidence-based care. Providers should be alert to the high risk of psychological comorbidities and screen patients for depression and anxiety upon initial presentation (Maurer et al., 2008). Early psychological assessment and intervention can be accomplished with addition of HRQoL evaluation using the VQ-11 scale, a short questionnaire completed by the patient, which provides a reliable COPD-specific HRQoL measure and is recommended for routine practice (Ninot et al., 2013). Early recognition, supportive care and treatment can ease the burden of psychological comorbidities in patients with COPD.

A holistic, integrated treatment plan will serve to optimize patient outcomes, decrease the burden of symptoms, prevent/manage exacerbations, slow disease progression, reduce disease morbidity and overall improve the HRQoL in the patient with COPD.

In summary, psychological and perceptual assessment should evolve as a new priority in clinical assessment of COPD patients. Females with COPD demonstrate increased physical and psychological burden from their disease, yet there is no specialized treatment plan to address this population. Future research should aim to quantify the predictors of psychological comorbidities in COPD patients and develop guidelines to address these factors.

7 Funding

This research has received no specific grant from any funding agency in the public, commercial or non-profit sectors.

References

- Alexander-Miller, S. & Davenport, P.W. (2010) Perception of multiple-breath inspiratory resistive loads in males and females. *Biological Psychology*, 84(1), pp.147-149.
- American Lung Association (ALA) (2013a) *Trends in COPD (chronic bronchitis and emphysema): morbidity and mortality*. [Online] Available from: <http://www.lung.org/finding-cures/our-research/trend-reports/copd-trend-report.pdf>. [Accessed: 20th January 2013].
- American Lung Association (ALA) (2013b) *Taking her breath away: the rise in COPD in women*. [Online] Available from: <http://www.lung.org/lung-disease/disparities-reports/rise-of-copd-in-women/>. [Accessed: 20th January 2013].
- Arne, M., Janson, C., Janson, S., Boman, G., Lindqvist, U., Berne, C. & Emtner, M. (2009) Physical activity and quality of life in subjects with chronic disease: chronic obstructive pulmonary disease compared with rheumatoid arthritis and diabetes mellitus. *Scandinavian Journal of Primary Health Care*, 27(3), pp.141-147.
- Atlantis, E., Fahey, P., Cochrane, B. & Smith, S. (2013) Bidirectional associations between clinically relevant depression or anxiety and COPD: a systematic review and meta-analysis. *Chest*, 144(3), pp.1084-1085.
- Burgel, P.R., Escamilla, R., Perez, T., Carré, P., Caillaud, D., Chanez, P., Pinet, C., Jebrak, G., Brinchault, G., Court-Fortune, I., Paillasseur, J.L. & Roche, N. for the INITIATIVES BPCO Scientific Committee (2013) Impact of comorbidities on COPD-specific health-related quality of life. *Respiratory Medicine*, 107(2), pp. 233-241.
- Centers for Disease Control and Prevention, United States Department of Health and Human Services (CDC) (2000) *Measuring healthy days: Population assessment of health-related quality of life*. [Online] Atlanta, Georgia: CDC. Available from: <http://www.cdc.gov/hrqol/pdfs/mhd.pdf/> [Accessed 31st January 2014].
- Centers for Disease Control and Prevention, United States Department of Health and Human Services (CDC) (2012) *CDC Wonder online database, compiled from Compressed Mortality File 1979-2009 Series 20 No. 20*. [Online] Available from: <http://wonder.cdc.gov/mortsql.html/> [Accessed 20th December 2013].
- Chan, P.Y., von Leupoldt, A., Bradley, M.M., Lang, P.J. & Davenport, P.W. (2012) The effect of anxiety on respiratory sensory gating measured by respiratory-related evoked potentials. *Biological Psychology*, 91(2), pp.185-189.
- Cote, C. & Chapman, K. (2009) Diagnosis and treatment considerations for women with COPD. *International Journal of Clinical Practice*, 63(3), pp.486-493.
- Cully, J.A., Graham, D.P., Stanley, M.A., Ferguson, C.J., Sharafkhaneh, A. Souček, J. & Kunik, M.E. (2006) Quality of life in patients with chronic obstructive pulmonary disease and comorbid anxiety or depression. *Psychosomatics*, 47(4), pp.312-319.
- Davenport, P.W. & Vovk, A. (2009) Cortical and subcortical central neural pathways in respiratory sensations. *Respiratory and Physiological Neurobiology*, 167(1), pp.72-86.
- de Torres, J.P., Casanova, C., Hernández, C., Abreu, J., Montejo de Garcini, A., Aguirre-Jaime, A. & Celli, B.R. (2006) Gender differences in determinants of quality of life in patients with COPD: a case series study. *Health and Quality of Life Outcomes*, 28(4), p.72.
- Di Marco, F., Verga, M., Reggente, M., Maria Casanova, F., Santus, P. Blasi, F., Allegra, L. & Centanni, S. (2006) Anxiety and depression in COPD patients: the roles of gender and disease severity. *Respiratory Medicine*, 100(10), pp.1767-74.
- García-Olmos, L., Alberquilla, A., Ayala, V., García-Sagredo, P., Morales, L., Carmona, M., José De Tena-Dávila, M., Pascual, M., Muñoz, A., Salvador, C. & Monteagudo, J. (2013) Comorbidity in patients with chronic obstructive pulmonary disease in family practice: a cross sectional study. *BMC Family Practice*, 14, p.11.
- Global Initiative for Chronic Obstructive Lung Disease (GOLD) (2014) *GOLD teaching slide set: global strategy for diagnosis, management and prevention of COPD*. [Online] Available from: http://www.goldcopd.org/uploads/users/files/GOLD_Report_2014_Jan23.pdf/ [Accessed 29th January 2014].
- Haave, E., Skumlien, S. & Hyland, M.E. (2008) Gender considerations in pulmonary rehabilitation. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 28(3), pp.215-219.
- Janssens, T., De Peuter, S., Stans, L., Verleden, G., Troosters, T., Decramer, M. & Van den Bergh, O. (2011) Dyspnea perception in COPD: association between anxiety, dyspnea-related fear, and dyspnea in a pulmonary rehabilitation program. *Chest*, 140(3), pp.618-625.
- Ketelaars, C.A., Schlösser, M.A., Mostert, R., Huyer Abu-Saad, H., Halfens, R.J. & Wouters, E.F. (1996) Determinants of health-related quality of life in patients with chronic obstructive pulmonary disease. *Thorax*, 51(1), pp.39-43.
- Kunik, M.E., Roundy, K., Veasey, C., Souček, J., Richardson, P., Wray, N.P. & Stanley, M.A. (2005) Surprisingly high prevalence of anxiety and depression in chronic breathing disorders. *Chest*, 127(4), pp.1205-1211.
- Light, R.W., Merrill, E.J., Despars, J.A., Gordon, G.H. & Mutalipassi, L.R. (1985) Prevalence of depression and anxiety in patients with COPD: relationship to functional capacity. *Chest*, 87(1), pp.35-38.
- Martinez, C.H., Raparla, S., Plauschinat, C.A., Giardino, N.D.,

- Rogers, B., Beresford, J., Bentkover, J.D., Schachtner-Appel, A., Curtis, J.L., Martinez, F.J. & Han, M.K. (2012) Gender differences in symptoms and care delivery for chronic obstructive pulmonary disease. *Journal of Women's Health*, 21(12), pp.1267-1274.
- Maurer, J., Rebbapragada, V., Borson, S., Goldstein, R., Kunik, M.E., Yohannes, A.M. & Hanania, N.A. for the ACCP Workshop Panel on Anxiety and Depression in COPD (2008) Anxiety and depression in COPD: current understanding, unanswered questions, and research needs. *Chest*, 134 (4 Suppl.), pp.43S-56S.
- Mikkelsen, R.L., Middelboe, T., Pisinger, C. & Stage K.B. (2004) Anxiety and depression in patients with chronic obstructive pulmonary disease (COPD): a review. *Nordic Journal of Psychiatry*, 58, pp.65-70.
- Nabaran, K., Azpeitia, A., Cantoni, J. & Miravittles, M. (2012) Impairment of quality of life in women with chronic obstructive pulmonary disease. *Respiratory Medicine*, 106(3), pp.367-73.
- Nardi, A.E., Freire, R.C. & Zin, W.A. (2009) Panic disorder and control of breathing. *Respiratory Physiology and Neurobiology*, 167(1), pp.133-143.
- National Institute for Health and Care Experience (NICE) (2014) *Depression in adults with a chronic physical health problem: treatment and management*. [Online] Available from: <http://publications.nice.org.uk/depression-in-adults-with-a-chronic-physical-health-problem-cg91> [Accessed 3rd March 2014].
- Ninot, G., Soyeux, F. & Préfaut, C. (2013) A short questionnaire for the assessment of quality of life in patients with chronic obstructive pulmonary disease: psychometric properties of VQ11. *Health and the Quality of Life Outcomes*, 11, p.179.
- Ng, T. P., Niti, M., Tan, W. C., Cao, Z., Ong, K. C. & Eng, P. (2007) Depressive symptoms and chronic obstructive pulmonary disease: effect on mortality, hospital readmission, symptom burden, functional status, and quality of life. *Archives of Internal Medicine*, 167, pp.60-67.
- Nishimura, K., Oga, T., Ikeda, A., Hajiro, T., Tsukino, M. & Koyama, H. (2008) Comparison of health-related quality of life measurements using a single value in patients with asthma and chronic obstructive pulmonary disease. *Journal of Asthma*, 45(7), pp.615-620.
- Pappens, M., Smets, E., Van Den Bergh, O. & Van Diest, I. (2012a) Fear of suffocation alters respiration during obstructed breathing. *Psychophysiology*, 49(6), pp.829-832.
- Pappens, M., Smets, E., Vansteenkoven, D., Van Den Bergh, O. & Van Diest, I. (2012b) Learning to fear suffocation: a new paradigm for interoceptive fear conditioning. *Psychophysiology*, 49(6), pp.821-828.
- Pitta, F., Troosters, T., Probst, V.S., Spruit, M.A., Decramer, M. & Gosselink, R. (2006) Physical activity and hospitalization for exacerbation of COPD. *Chest*, 129(3), pp.536-544.
- Raherison C., Tillie-Leblond, I., Prudhomme, A., Taillé, C., Biron, E., Nocent-Ejnaini, C., Mathieu, B. & Ostinelli, J. (2014) Clinical characteristics and quality of life in women with COPD: an observational study. *BMC Women's Health*, 14(1), p.31.
- Sinha, S. Papp, L.A. & Gorman, J.M. (2000) How study of respiratory physiology aided our understanding of abnormal brain function in panic disorder. *Journal of Affective Disorders*, 61(3), pp.191-200.
- Stapleton, R.D., Neilsen, E.L., Engelberg, R.A., Patrick, D.L. & Curtis, J.R. (2005) Association of depression and life-sustaining treatment preferences in patients with COPD. *Chest*, 127(1), pp.328-334.
- Thomas, M., Decramer, M. & O'Donnell, D.E. (2013) No room to breathe: the importance of lung hyperinflation in COPD. *Primary Care Respiratory Journal*, 22(1), pp.101-111.
- Turan, O., Yemez, B. & Itil, O. (2013). The effects of anxiety and depression symptoms on treatment adherence in COPD patients. *Primary Health Care Research and Development*, 8, pp.1-8.
- van Haren-Willems, J. & Heijdra, Y. (2010) Increasing evidence for gender differences in chronic obstructive pulmonary disease. *Women's Health*, 6(4), pp.595-600.
- Varkey, A.B. (2004) Chronic obstructive pulmonary disease in women: exploring gender differences. *Current Opinions in Pulmonary Medicine*, 10(2), pp.98-103.
- Yohannes, A.M., Baldwin, R.C. & Connolly, M.J. (2000) Depression and anxiety in elderly outpatients with chronic obstructive pulmonary disease: prevalence, and validation of the BASDEC screening questionnaire. *International Journal of Geriatric Psychiatry*, 15, pp.1090-1096.
- Zoeckler, N., Kenn, K., Kuehl, K., Stenzel, N. & Rief, W. (2014) Illness perceptions predict exercise capacity and psychological well-being after pulmonary rehabilitation in COPD patients. *Journal of Psychosomatic Research*, 76, pp.146-151.
- Zoeckler, N., Rief, W., Kuehl, K. & Kenn, K. (2012) COPD-specific anxiety and depressive symptoms in COPD patients. *Pneumologie*, 66, pp.290-296.