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Effectiveness of Autogenic Drainage and Pursed Lip Breathing Exercises in Patients with COPD- A Case Series

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ABSTRACT

Background: Autogenic drainage (AD) and pursed-lip breathing (PLB) are physiologically complementary techniques that target secretion retention and dynamic airway collapse in chronic obstructive pulmonary disease (COPD). Evidence for their combined use across patient-centered outcomes remains limited.
Objective: To evaluate the effectiveness of a four-week combined AD and PLB exercise program on dyspnea, cough-related quality of life, functional exercise capacity, and COPD-related health status. Methods: A pre–post case series included five medically stable patients with severe COPD (GOLD grade 3), recruited by convenience sampling. Participants performed AD and PLB for 30 minutes per session, six sessions per week, for four weeks. Outcomes were assessed at baseline and follow-up using the modified Medical Research Council (mMRC) dyspnea scale, Leicester Cough Questionnaire (LCQ), one-minute sit-to-stand test (1-min STS), and COPD Assessment Test (CAT). Paired-samples t-tests were used for within-group comparisons.
Results: The mean age was 63.00 ± 6.04 years. The mMRC score decreased from 3.20 ± 0.84 to 1.40 ± 0.55 (mean change −1.80; p = 0.009), and the LCQ score increased from 7.396 ± 2.890 to 10.502 ± 3.478 (mean change +3.106; p = 0.001). The 1-min STS improved from 0.00 ± 0.00 to 4.60 ± 1.14 repetitions (p < 0.001), while the CAT score decreased from 33.20 ± 5.81 to 24.00 ± 7.35 (mean change −9.20; p = 0.021). All five participants improved on every outcome.
Conclusion: A four-week combined AD and PLB program was associated with short-term improvements in dyspnea, cough-related quality of life, functional exercise capacity, and COPD-related health status. Larger controlled studies with longer follow-up are required to confirm effectiveness and durability.

KEY WORDS: Autogenic drainage; Pursed-lip breathing; Chronic obstructive pulmonary disease; Airway clearance; Dyspnea; Pulmonary rehabilitation

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a heterogeneous lung condition characterized by persistent respiratory symptoms and airflow limitation that is not fully reversible. Chronic cough, sputum production, exertional dyspnea, fatigue, and

reduced exercise tolerance contribute to substantial disability and impaired health-related quality of life. The diagnosis is confirmed by post-bronchodilator spirometry, while symptom burden and functional limitation require separate clinical assessment.[1] COPD remains a major cause of global morbidity and mortality, with its burden influenced by tobacco exposure, biomass smoke, occupational exposures, air pollution, and population ageing. [2,3]

The pathophysiology of COPD involves chronic airway inflammation, small-airway remodeling, mucus hypersecretion, ciliary dysfunction, and parenchymal destruction. Neutrophils, macrophages, oxidative stress, and protease–antiprotease imbalance contribute to tissue injury and progressive airflow obstruction.[4] Retained secretions further increase airway resistance, impair ventilation, and provide a substrate for recurrent infection. Expiratory flow limitation and dynamic airway collapse can also promote air trapping and hyperinflation, intensifying breathlessness during daily activity.

Airway clearance techniques are intended to mobilize and evacuate secretions while minimizing excessive expiratory effort. Autogenic drainage (AD) is a self-administered technique that uses controlled breathing at low, mid, and high lung volumes to unstick, collect, and evacuate mucus. Because airflow and lung volume are actively regulated, AD can be performed without external devices or manual assistance.[5] Although its physiological rationale is relevant to mucus retention in COPD, much of the original evidence arose in cystic fibrosis, and the COPD-specific evidence base remains comparatively limited.[6]

Pursed-lip breathing (PLB) is a breathing-retraining strategy in which nasal inhalation is followed by prolonged, gentle exhalation through narrowed lips. The resulting expiratory back-pressure may help stabilize collapsible airways, prolong expiration, reduce air trapping, and improve breathing control. PLB is simple, inexpensive, and suitable for self-management at rest and during exertion. Clinical research has reported improvements in exertional dyspnea and physical function following PLB training.[7] A recent systematic review also found that breathing exercises, including PLB, may reduce breathlessness and improve health-related quality of life in people with serious respiratory illness.[8]

AD and PLB address complementary problems: AD focuses on secretion mobilization, whereas PLB focuses on expiratory flow control and dynamic airway stability. Their combination may therefore reduce both the secretory and ventilatory contributors to symptoms. Modern pulmonary rehabilitation emphasizes individualized, patient-tailored interventions based on comprehensive assessment, making low-cost techniques that can be integrated into self-management particularly relevant.[9] However, published evaluations of the combined AD–PLB approach across dyspnea, cough-related quality of life, functional capacity, and disease-specific health status are limited.

This study aimed to evaluate the effectiveness of a structured four-week program combining AD and PLB exercises in patients with severe COPD.

MATERIALS AND METHODS

Study design and sample

A pre–post case-series design was used. Five medically stable patients with severe COPD were recruited by convenience sampling from the outpatient physiotherapy facility of the authors' institution. The study purpose and procedures were explained to each participant, and written informed consent was obtained before enrolment. Participants continued their usual prescribed medical treatment throughout the study.

Participants

Adults aged 55–75 years were eligible if they had a confirmed COPD diagnosis with post-bronchodilator airflow obstruction, severe airflow limitation consistent with GOLD grade 3 (forced expiratory volume in one

second [FEV_1] 30%–49% predicted), no acute exacerbation during the preceding four weeks, baseline dyspnea graded 2–4 on the mMRC scale, adequate cognitive and physical ability to perform the assessments and breathing techniques, and willingness to attend the scheduled intervention sessions.

Patients were excluded if they had unstable cardiac disease, uncontrolled hypertension, recent myocardial infarction, or another medical contraindication to exercise testing or training; severe musculoskeletal or neurological impairment limiting functional testing; recent thoracic or abdominal surgery; untreated pneumothorax; severe cognitive impairment preventing safe participation; or physician advice against respiratory exercise or functional testing.

Baseline assessment

Before the intervention, demographic and clinical information was recorded, including age, smoking history, medical history, medication use, and recent exacerbation history. Resting heart rate, respiratory rate, blood pressure, and peripheral oxygen saturation (SpO_2) were documented. Dyspnea was graded using the mMRC scale, cough-related quality of life was assessed using the LCQ, functional exercise capacity was measured using the 1-min STS, and COPD-related health status was assessed using the CAT.

Intervention

Autogenic drainage: Participants were positioned comfortably in sitting with a neutral spine and relaxed shoulders. After instruction in diaphragmatic breathing, each participant was taught to regulate the depth and location of breathing to mobilize secretions. The technique progressed through three phases: low-lung-volume breathing with gentle prolonged exhalation to loosen peripheral secretions; mid-lung-volume breathing with slightly deeper inspirations to collect secretions in the central airways; and high-lung-volume breathing followed by huffing with an open glottis to evacuate secretions. Expiratory airflow was controlled to avoid forced airway collapse and desaturation. Cycles were repeated as tolerated, with productive coughing encouraged at the end of each cycle. Participants practiced under supervision until they could perform the technique independently.

Pursed-lip breathing: In comfortable sitting, participants inhaled slowly through the nose for approximately two seconds and then exhaled gently through pursed lips for approximately four seconds, maintaining an expiration-to-inspiration ratio of about 2:1. They were instructed to relax the neck and shoulders and avoid forced or strained exhalation. PLB was practiced at rest and participants were encouraged to use it during exertion and episodes of breathlessness.

Training dose: The combined AD and PLB program was performed for 30 minutes per session, six sessions per week, for four consecutive weeks. Rest periods were provided whenever fatigue or discomfort occurred, and the number of cycles was adjusted to individual tolerance while preserving correct technique.

Monitoring: Symptoms and tolerance were monitored during training. Heart rate, SpO_2, perceived exertion, and dyspnea were assessed as clinically required. Training was stopped for chest pain, severe breathlessness, dizziness, fainting, marked oxygen desaturation, or other concerning symptoms, with medical attention provided according to institutional protocol. Any change in medication or additional rehabilitation during the study was to be documented.

Post intervention assessment

After completion of the four-week program, the mMRC, LCQ, 1-min STS, and CAT assessments were repeated under conditions comparable to baseline. Pre- and post-intervention scores were paired for each participant to determine within-person change.

Outcome measure

The mMRC scale grades activity-related breathlessness from 0 to 4, with higher

grades indicating greater disability. A reduction in grade indicates improvement in dyspnea. The CAT contains eight items addressing cough, phlegm, chest tightness, breathlessness, activity limitation, confidence, sleep, and energy. Each item is scored from 0 to 5, yielding a total score of 0–40; lower scores indicate less COPD-related health impact.

The LCQ is a 19-item questionnaire covering physical, psychological, and social domains of cough-related quality of life. Domain scores range from 1 to 7 and the total score ranges from 3 to 21, with higher scores indicating better cough-related quality of life.

For the 1-min STS, participants repeatedly stood fully from and returned to a standard-height chair for one minute at a safe, self-selected pace. The number of completed repetitions was recorded, with a higher count indicating better functional exercise capacity.

Statistical analysis

Continuous data were summarized as mean ± standard deviation (SD), and age was additionally described by its observed range. Pre- and post-intervention outcomes were compared using two-tailed paired-samples t-tests. Mean change was calculated as follow-up minus baseline; absolute t values are reported. A p value < 0.05 was considered statistically significant. Given the exploratory nature of this five-case series, the analyses were interpreted alongside individual response patterns and clinical relevance rather than as definitive evidence of efficacy.

RESULTS

All five participants completed the four-week intervention and paired assessments. Ages ranged from 57 to 73 years, with a mean of 63.00 ± 6.04 years. Individual baseline and follow-up data are presented in Table 1. Every participant demonstrated improvement in mMRC grade, LCQ score, 1-min STS performance, and CAT score.

Table 1: Individual case data and outcome scores at baseline and follow-up (n = 5)

Overall finding of the study

The study included patients with COPD, with a mean age of 63.000 ± 6.042 years.

Table 1: Comparison of mMRC, Leicester, Sit-to-Stand Test and CAT Scores at Baseline and Follow-up

		Mean	Std. Deviation	Enhancement/ Decrement	t value	p value
mMRC	Baseline	1.400	0.548	1.800	4.811	0.009*
	Follow up	3.200	0.837			
Leicester	Baseline	7.396	2.890	3.106	8.060	0.001*
	Follow up	10.502	3.478			
Sit to stand test	Baseline	0.000	0.000	3.800	4.417	0.012*
	Follow up	3.800	1.924			
CAT	Baseline	33.200	5.805	9.200	3.713	0.021*
	Follow up	24.000	7.348			

Autogenic Drainage combined with Pursed-Lip Breathing showed significant improvement in dyspnea, cough-related quality of life, and functional exercise capacity in patients with COPD. Consistent improvements in mMRC, LCQ, and Sit-to-Stand test performance.

DISCUSSION

This case series examined a four-week combined AD and PLB exercise program in five patients with severe COPD. Statistically significant pre–post improvements were observed across all four outcomes: mMRC dyspnea grade and CAT score decreased, while LCQ score and 1-min STS performance increased. The consistency of improvement across all participants and the magnitude of change in the patient-reported outcomes suggest potentially meaningful short-term benefit, although the uncontrolled design precludes definitive causal inference.

The reduction in mMRC grade indicates improved tolerance of daily activity. PLB

may contribute by prolonging expiration, generating mild expiratory back-pressure, and reducing dynamic airway collapse and air trapping. Improved breathing control may also reduce the distress associated with exertion. Nield et al. reported sustained improvement in exertional dyspnea and physical function after PLB retraining, and the direction of their findings is consistent with the present cases.[7] More broadly, Burge et al. found that breathing exercises may reduce breathlessness and improve quality of life, while noting uncertainty about the magnitude and clinical importance of effects across studies.[8] The larger mMRC change observed here should therefore be interpreted cautiously in light of the small sample and absence of a comparator.

Cough-related quality of life improved by a mean of 3.106 LCQ points. All five participants exceeded the proposed 1.3-point MCID for COPD, supporting the clinical relevance of the observed change.[14] AD may have contributed by mobilizing retained secretions and reducing the mechanical and inflammatory stimuli that sustain cough. This explanation remains indirect because sputum volume, sputum viscosity, cough frequency, and objective airway-clearance measures were not assessed. Nevertheless, the LCQ findings complement the physiological rationale for AD as a device-free method of secretion clearance. [5,6]

Evidence from related airway-clearance approaches supports further investigation of secretion-focused interventions in COPD. Alghamdi et al. reported benefits from oscillatory positive expiratory pressure therapy in a randomized trial, although that technique differs from AD and the findings cannot be directly transferred between methods.[16] Similarly, Li et al. found that pulmonary rehabilitation incorporating active cycle of breathing and oscillatory positive expiratory pressure was associated with improved mucus-related and patient-reported outcomes in a retrospective cohort.[17] The present study adds preliminary case-level evidence specifically for a combined AD–PLB program rather than device-assisted airway clearance.

Functional exercise capacity, as measured by the 1-min STS, improved in every participant. Reduced dyspnea and improved symptom control may have enabled participants to sustain repeated standing activity for longer. However, the intervention did not include progressive lower-limb strengthening, and the baseline value of zero repetitions makes practice effects, familiarization, and changes in test tolerance particularly important alternative explanations. The 1-min STS result should therefore be viewed as a functional observation requiring confirmation under controlled conditions rather than evidence of improved muscle strength.

The mean CAT reduction of 9.20 points was substantially greater than the 2-point MCID, and all participants achieved individually meaningful reductions.[15] Because the CAT integrates symptoms, activity limitation, sleep, confidence, and energy, its improvement suggests that the combined intervention was associated with benefits beyond a single symptom domain. The parallel improvement in CAT, LCQ, and mMRC scores strengthens the clinical coherence of the findings, although shared self-report bias cannot be excluded.

Individual responses varied. Case 1 demonstrated an 18-point CAT reduction and a three-grade mMRC improvement, whereas Case 5 showed smaller but still clinically meaningful changes. This variability is expected in a heterogeneous condition such as COPD and may reflect differences in baseline symptom burden, secretion retention, adherence, comorbidity, or functional reserve. The small sample did not permit analysis of predictors of response. Future studies should document these characteristics prospectively and examine whether patients with prominent mucus hypersecretion derive greater benefit from the AD component.

Several limitations must be emphasized. The study included only five participants recruited by convenience sampling, with no

control or sham-intervention group. Natural fluctuation, regression to the mean, concurrent medication effects, learning effects, and placebo responses cannot be excluded. Follow-up was limited to four weeks, and no assessment was made of sustained benefit, exacerbations, hospitalization, or long-term adherence. Blinding was not feasible, and three outcomes relied on participant report. Paired parametric testing in a very small sample, including the ordinal mMRC scale, provides exploratory rather than definitive inference. In addition, the combined protocol cannot separate the independent contribution of AD from that of PLB. Larger randomized controlled trials with longer follow-up, objective secretion and physiological measures, and adequately characterized participants are warranted.

CONCLUSION

A four-week program combining autogenic drainage and pursed-lip breathing was associated with improvements in dyspnea, cough-related quality of life, one-minute sit-to-stand performance, and COPD-related health status in all five participants. The changes in LCQ and CAT scores also exceeded published thresholds for clinical importance. These findings support combined AD and PLB as a potentially useful, low-cost adjunct to conventional COPD management, but they should be considered preliminary.

Declaration by Authors

Ethical Approval: The source project did not report an institutional ethics committee approval number. Written informed consent was obtained from all participants before enrolment.

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Conflict of Interest: The authors declare no conflict of interest.

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