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Domiciliary High-Flow Nasal Cannula Oxygen Therapy for Stable Hypercapnic COPD Patients: A Multicenter, Randomized Crossover Trial

AIM:

To compare the efficacy and safety of domiciliary nasal high flow (NHF) and long-term oxygen therapy (LTOT) vs. LTOT alone in patients with stable hypercapnic chronic obstructive pulmonary disease (COPD)

METHOD:

Patient group

Adult patients (20 years or older) with stable hypercapnic COPD

- Global Initiative for Obstructive Lung Disease (GOLD) stages 2 to 4, receiving LTOT for a minimum of 16 hours per day for at least 1 month
- Patients were excluded if they had experienced a COPD exacerbation or used nocturnal noninvasive ventilation within 6 weeks of enrollment, or had an active malignancy

Study design

Prospective multicenter, randomized cross-over trial in nine hospitals in Japan

Outcome measures

- Primary outcome: change in quality of life (QOL) as assessed by St. George's Respiratory Questionnaire for COPD (SGRQ-C)
- Secondary outcomes: changes in each component of the SGRQ-C, EuroQol-5-Dimensional Questionnaire (EQ-5D-5L), dyspnea (modified MRC scale), arterial blood gas analysis, nocturnal partial pressure of transcutaneous carbon dioxide ($PtcCO_2$), oxygen saturation by pulse oximetry (SpO_2), pulmonary function tests, 6-minute walk test (6MWT), physical activity level, number of COPD exacerbations, changes in medication, and adverse events

Treatment regimen

- Participants initially received either NHF plus LTOT (group A) or LTOT only (group B) for 6 weeks and then crossed over to the alternative treatment
- NHF was administered using the myAIRVO™ 2 device via an Optiflow™ nasal cannula interface (Fisher & Paykel Healthcare)
- Participants were instructed to use NHF/LTOT for at least 4 hours per night during sleep at flow rates of 30 to 40 L/min
    - The nocturnal oxygen flow rate was adjusted to maintain SpO_2 > 88%
    - The flow rate could be down-titrated to 20 L/min if discomfort was reported
    - LTOT was continued during daytime hours
- At the start of each treatment period, participants were hospitalized for at least 3 days for clinical measurements and QOL assessment
- Participants were discharged once they were comfortable using the myAIRVO 2 device and readmitted at the end of the study for final measurements

RESULTS:

Enrolled patients

- 29 out of a total of 32 patients completed the study (13 in group A and 16 in group B)
- Baseline characteristics were similar between treatment groups
    - Most patients were elderly males with severe air-flow obstruction, mild hypercapnia and receiving LTOT at a flow rate of 0.25 to 4 L/min
- Mean flow rate of NHF was around 30 L/min in both groups, and mean usage time (hours/night ± SD) was 7.1 ± 1.5 in group A and 8.6 ± 2.9 in group B

Outcomes

- NHF/LTOT significantly improved the mean SGRQ-C total score vs. LTOT alone (7.8 points; 95% confidence interval [CI], 3.7 to 11.9; $p < 0.01$)
    - All components of the SGRQ-C were significantly improved
- Significant improvements were also seen in PaCO2, pH, and nocturnal PtcCO2 with NHF/LTOT vs. LTOT alone
- PaO_2, SpO_2, dyspnea, spirometry, lung volumes, 6MWT, and physical activity did not differ significantly between treatment groups
- The EQ visual analogue scale was significantly improved with NHF/LTOT vs. LTOT (7.9 points; 95% CI, 2.9 to 12.9, $p < 0.01$); however, the mean EQ-5D-5L score was similar in both treatment groups
- No patients had an exacerbation of COPD during NHF/LTOT, whereas three patients had this event during LTOT alone
- Mild nocturnal sweating was the most frequently reported NHF-related adverse event (n = 6, 20.7%)

CONCLUSION:

Six weeks of therapy with NHF plus LTOT was associated with improved health-related QOL and reduced hypercapnia compared with LTOT alone in patients with stable hypercapnic COPD

KEY POINTS:

- NHF/LTOT significantly improved the mean SGRQ-C total score and all individual components compared with LTOT alone in patients with stable hypercapnic COPD
- Hypercapnia was significantly reduced with NHF/LTOT compared with LTOT alone
- No exacerbations of COPD occurred during treatment with NHF/LTOT
- NHF was well-tolerated with no related severe adverse events