What To Do When Your Pulmonary Patient has High Oxygen Demands

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Lecture Objectives

1. Identify the clinical situations when a patient may need high flow oxygen.
2. Discuss the different ways to deliver high flow oxygen in a pulmonary rehabilitation program
3. Communicate the increased oxygen need to your patient to improve their understanding.

Outline for today…in no particular order!

- Understand the disease processes that may require higher oxygen.
- How to utilize your oxygen assessment for resting and exertional oxygen needs.
- Researching and gathering the needed supplies and resources to provide oxygen to your patient.
- Assisting the patient in obtaining the correct oxygen for use at home.

The Patient

- You evaluate your patient.
- You find out the following:
  - They have pulmonary fibrosis or another lung disease
  - Use their oxygen when they are doing activities
    - They have pulse dose POC
  - When they get short of breath they increase the setting
  - Don’t always check their saturations at home or don’t have a pulse oximeter at home
    - No one has explained to them how to read it accurately
- Listening to this information, you may get worried about oxygen needs and exercise!

Now what?

- Review patient's current oxygen prescription
- Review home oxygen equipment
  - More on this later
- Make the clinical decision to do any oxygen assessment early on, maybe before the six-minute walk
  - Technically oxygen should be assessed prior to a walk if you think it would affect the walk outcome.

Assessing oxygen needs

It’s not a six minute walk!!!!!!!!

Assess with their device they use daily

- Does this system support the patient needs?

Follow Medicare Guidelines! ☺

Currently there is not a “standard” oxygen assessment tool.

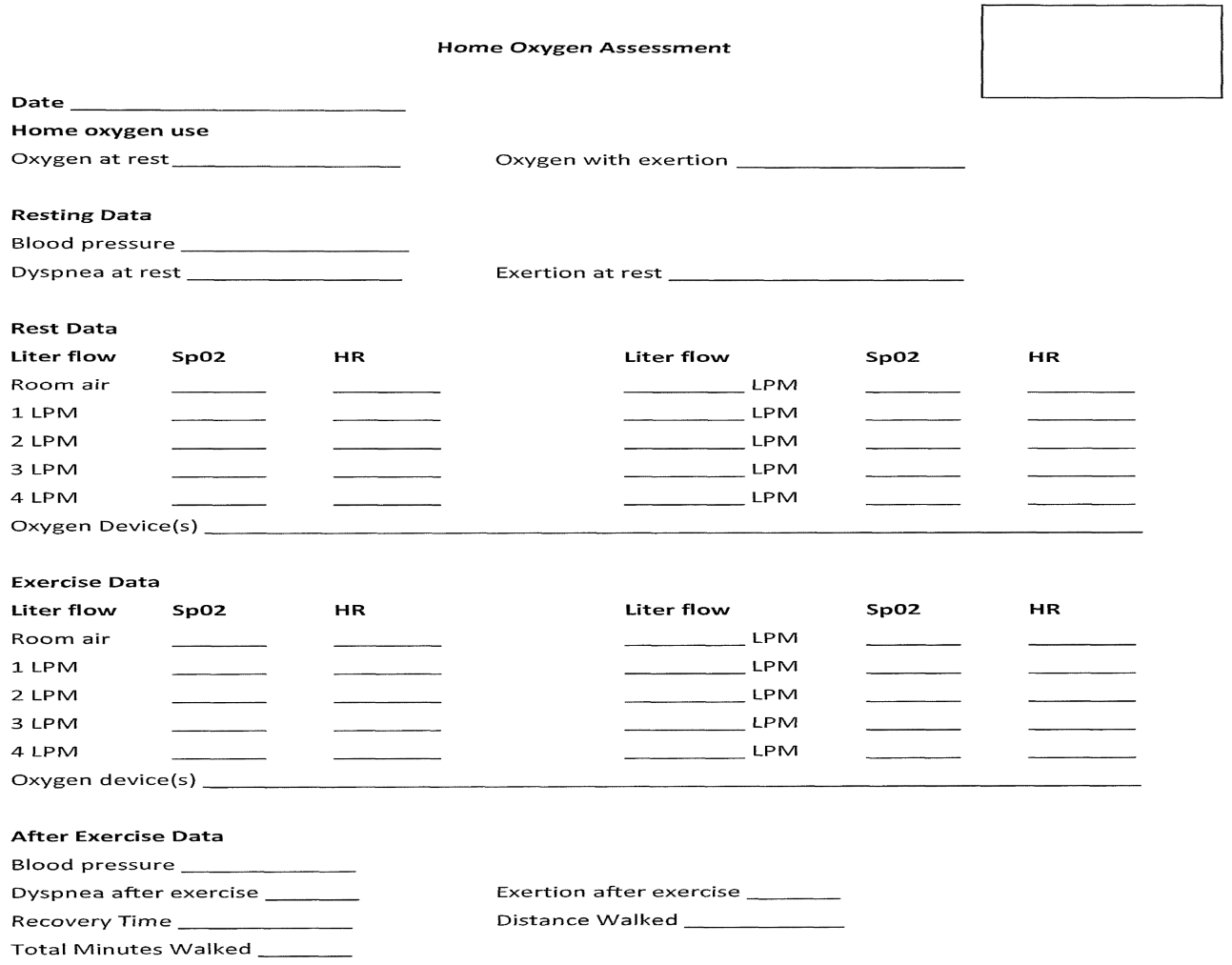
- Resting oxygen SpO2
- With activity at each liter flow
- Device patient uses

Assure that patient gets new orders and new devices for home use!

Oxygen Assessment

- CMS states when applicable the patient's medical record must have documentation that describes any concerns for variations in oxygen measurements that may result from such factors as:
  - Patient's age
  - Patient's skin pigmentation
  - Altitude level
  - Decrease in oxygen carrying capacity

- Oxygen assessment will provide the provider with the necessary data to write the oxygen order
  - Liter flow
  - Device



Home Oxygen Assessment

Date _____

Home oxygen use

Oxygen at rest _____ Oxygen with exertion _____

Resting Data

Blood pressure _____

Dyspnea at rest _____ Exertion at rest _____

Rest Data

Liter flow	Sp02	HR	Liter flow	Sp02	HR
Room air	_____	_____	_____ LPM	_____	_____
1 LPM	_____	_____	_____ LPM	_____	_____
2 LPM	_____	_____	_____ LPM	_____	_____
3 LPM	_____	_____	_____ LPM	_____	_____
4 LPM	_____	_____	_____ LPM	_____	_____

Oxygen Device(s) _____

Exercise Data

Liter flow	Sp02	HR	Liter flow	Sp02	HR
Room air	_____	_____	_____ LPM	_____	_____
1 LPM	_____	_____	_____ LPM	_____	_____
2 LPM	_____	_____	_____ LPM	_____	_____
3 LPM	_____	_____	_____ LPM	_____	_____
4 LPM	_____	_____	_____ LPM	_____	_____

Oxygen device(s) _____

After Exercise Data

Blood pressure _____

Dyspnea after exercise _____ Exertion after exercise _____

Recovery Time _____ Distance Walked _____

Total Minutes Walked _____

Oxygen Assessment

Establish resting vitals

- HR, BP, SpO_2
- Dyspnea and fatigue using BORG scale

If patient is on oxygen, remove oxygen for 10-15 minutes or until patient desaturates to ≤88%. (89% in PHTN)

For resting oxygen assessment, increase oxygen by1 LPM at a time until patient's SpO_2 is > 88%

- Record each SpO_2 & heart rate for each LPM change.
- Once patient continues to stay > 88% you have established their resting oxygen needs.

To continue for exercise/exertion needs (remember to meet the needs of your patient's home exertion)

- Start at resting LPM
- Begin walking, once patient's oxygen drops below 88%, begin increasing LPM from baseline.
- Record each SpO_2 heart rate for each LPM change.
- Once patient maintains > 88% you have established their resting oxygen needs.
- Record total time walked. Distance, if able to record. Blood pressure at end of walk. Dyspnea and fatigue

Oxygen Assessment

If the patient is completing test as an outpatient, it must be within 30 days of a provider visit.

Some patients present a bigger challenge with oxygen assessments-

- ILD patients who have delayed desaturations and take longer to recover.
  - Clinically we often may start higher flows on these patients and lower them until we meet their exact needs.
  - It is often hard to “catch” them up and we can overshoot their exact need.

Always need to assess at 4 LPM to establish the higher need.

Always make sure you are meeting the patient’s needs with exertional activities.

Make sure your documentation is clear for all oxygen settings.

- Rest, exertion, device

Patients who want to use a POC should be assessed for the settings on their specific device.

Oxygen assessments for Medicare must be completed yearly.

Physicians/Practitioners must sign a CMN – Certificate of Medical Necessity for oxygen

- So, your documentation is important!

Patients……

Oxygen use is often the most non-adherent drug we see in pulmonary rehab

Cumbersome

It’s visual…others see

Patient’s may not understand the importance/harm if not used correctly

Education to our patients is vitally important

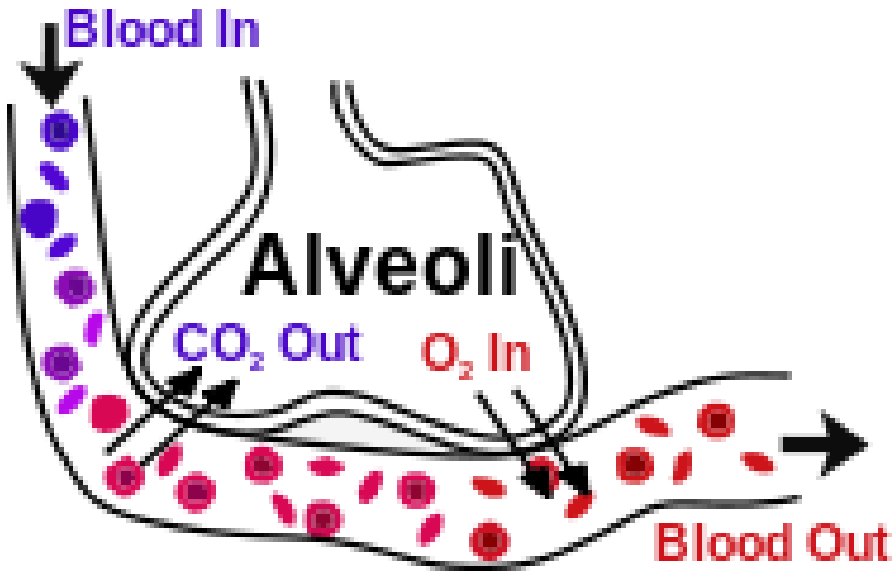
The Whys, the how's, the devices

What happens when they don’t use correctly

•Explain that physiology

The Diagnosis and Oxygen

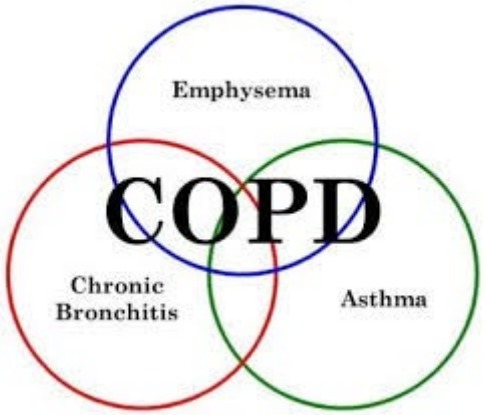
- Each patient has different needs based on their diagnosis!
- Pulmonary patients can be complicated!
  - Multiple diagnoses where oxygen is important
    - Heart disease
    - 2 kinds of lung diseases



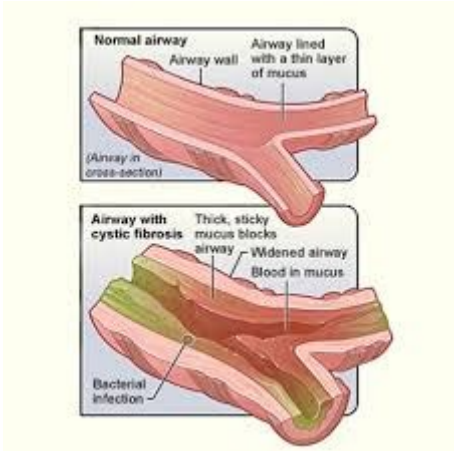
The Diagnosis and Oxygen

Obstructive Lung Diseases

- COPD
- Emphysema
- Asthma

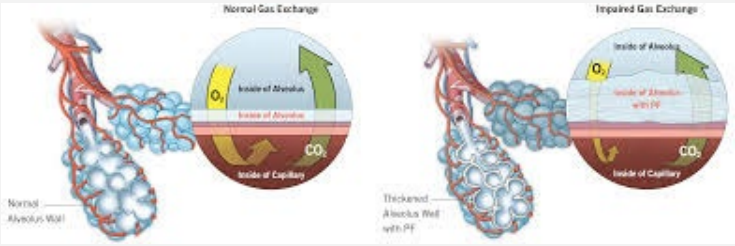


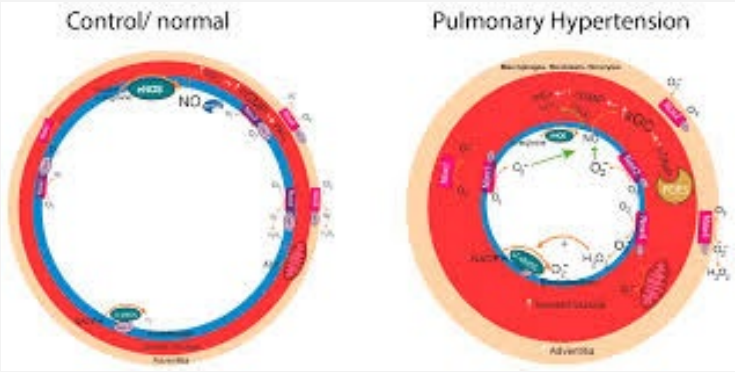
Cystic Fibrosis



Maintaining SpO2 > 90%

Avoid over oxygenating





The Diagnosis and Oxygen

- Interstitial Lung Diseases
  - Pulmonary Fibrosis
  - Sarcoidosis
  - Rheumatic Lung Disease
- Pulmonary Hypertension

- Maintain SpO2 ≥ 88-90%
- These patients have very different resting and exertional levels of oxygen!

Goals for oxygenating our patients

- Keep patient oxygenated
  - Be creative
  - Use whatever means you can
- Assess them as clinically warranted during PR
  - SpO2
  - Other symptoms
    - ↑HR, dizziness, syncope, dyspnea, chest pain
- Communicate patient needs with MD
- Work with patient's home care company- be patient's advocate

- Educate patient
  - Remember SOB ≠ hypoxia
  - Help them learn to read oximeter correctly
  - Discuss importance of oxygen use

Oxygen Devices

Using your pulse oximeter

- Some patients can be spot checked
- Others may need continuous monitoring
- Watch for decreased perfusion (hands), cold fingers, tight grip on equipment
- Have multiple oximeter probes
  - Finger
  - Ear
  - forehead

Oxygen Devices

- Nasal cannula
- High flow nasal cannulas
- Oxymizers
- Oxymask
- Non- rebreathers
- Venti Masks

Oxygen in your PR Department

E Cylinders

- Move from place to place with patient
- Flows 1-25 lpm
- Higher flows, lots of tanks

H Cylinders

- More stationary
- Good for your high flow needs patients
- “park” them in a high use space
- Reserve the equipment for those high flow patients

Liquid

- Refill patient’s supplies if needed

Pros

- Have oxygen available for your patients
- Able to meet all patient’s needs!!!
- Not using their system – saves oxygen supply for other uses

Cons

- Build the cost into your budget
  - Oxygen
  - Supplies
- Correct storage for your tanks
- Costly –oxygen, supplies and storage

Using the patient's Home Oxygen

- Utilize your oxygen assessment
- Be careful of using all of the patient's oxygen in PR
  - They still need to get home!
- Continue to assure they have the correct oxygen devices and prescription for home.
- May limit your ability to progress your patient

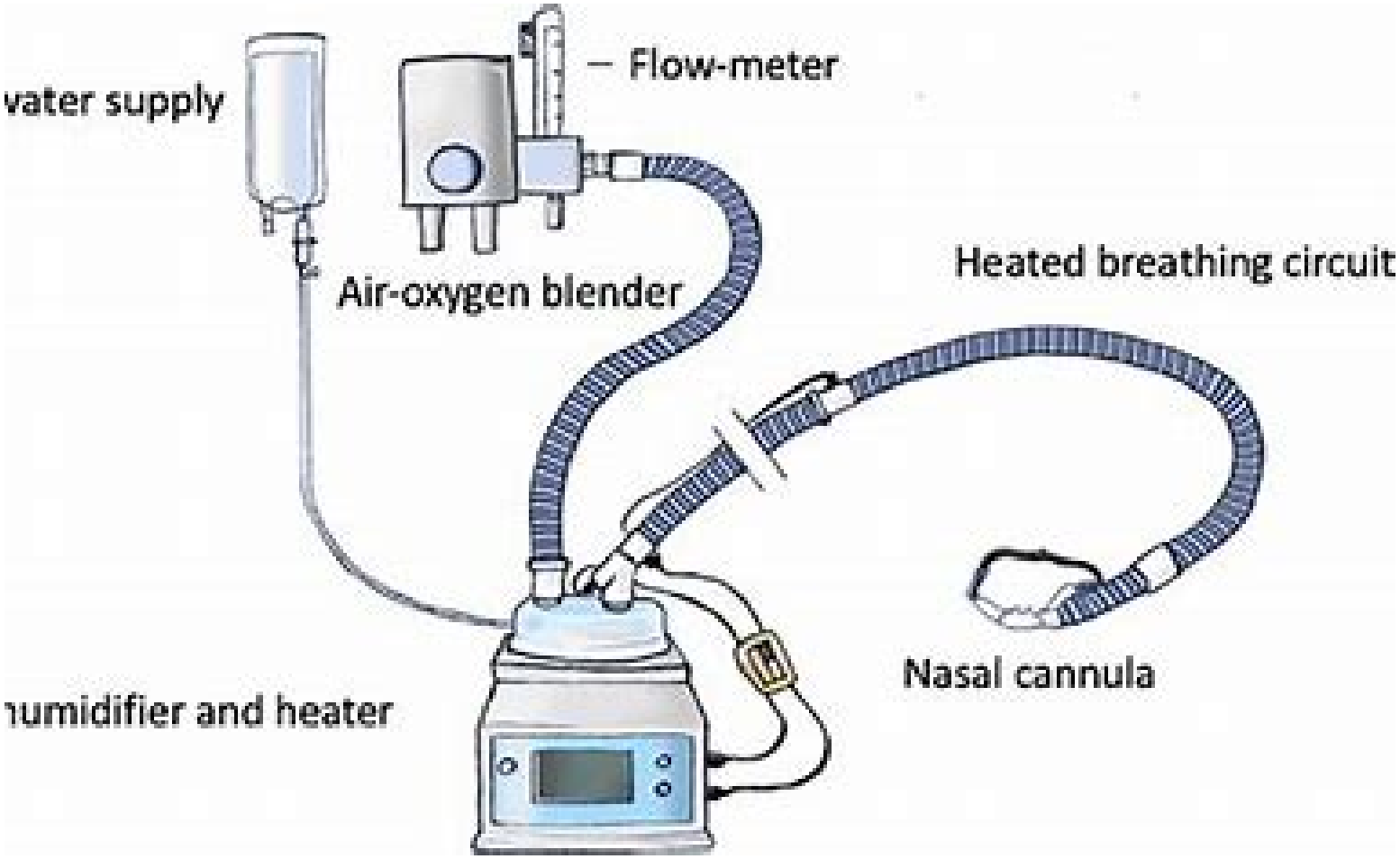
- May not be able to start patient until they get the correct oxygen for home for exertional activities
- Could get an extra supply for just those patients.
- Risk using all of your patient's oxygen during PR with none left for travel

What about high flow oxygen with heated humidity?

Here are some studies!

Biggest Con for a PR program – COST!!!

Heated high flow oxygen system



Research: Oxygen and PR

The Role of High-Flow Nasal Cannula Oxygen Therapy in Exercise Testing and Pulmonary Rehabilitation: A Review of the Current Literature by Claudio Candia 1ORCID,Carmen Lombardi 2,Claudia Merola 2,Pasquale Ambrosino 3ORCID,Silvestro Ennio D'Anna 2ORCID,Aldo Vicario 1,Stefania De Marco 1,Antonio Molino 1ORCID andMauro Maniscalco 1,2,*ORCID

- Utilized heated/humidified oxygen therapy – high flows controlled fiO2
- Studied different disease states – COPD, ILD, Lung Cancer
- Low number of studies to compare outcomes
- Evidence is pretty fragmented, with variable outcomes
- More trials are needed

Table 1. Studies assessing the role of HFNC in the ET/PR of COPD patients.

Study	Subjects	Design	Intervention	Performance Tests	Main Findings
Chao et al. (2021) [32]	30 stable COPD patients at discharge from PR	Randomized crossover trial	HFNC vs. COT	6MWT	↑ 6MWD *, ↔ Dyspnea, ↔ HR, ↔ BP, ↔ RR
Chihara et al. (2022) [34]	13 COPD patients with CRF	Single-center RCT/crossover trial	HFNC at 50 L/min and FiO_2 100% vs. Oxygen at 6 L/min through nasal cannula during PR	6MWT, Constant-load exercise testing at 80% maximal capacity	↑ 6MWD, ↔ Endurance time, ↔ Dyspnea, ↔ HR, ↔ BP, ↔ RR
Cirio et al. (2016) [35]	12 severe, stable, ventilatory-limited COPD patients	Randomized crossover trial	HFNC vs. VM at the same FiO_2	Constant-load exercise testing at 75% maximal capacity	↑ Endurance Time, ↑ SpO_2, ↓ Dyspnea
Fu et al. (2020) [36]	600 Stable COPD patients from eight studies	Metanalysis	HFNC vs. COT (six studies) HFNC vs. NIV (two studies)	6MWT, Constant-load exercise testing	↓ RR ^, ↔ PaO_2, ↑ SGRQ, ↑ 6MWD, ↔ Endurance Time
Vitacca et al. (2020) [37]	171 COPD patients undergoing PR	Multicenter RCT	HFNC vs. VM during PR	6MWT, Constant-load exercise testing	↑ 6MWD, ↔ Endurance Time
Volpi et al. (2022) [38]	31 COPD patients with nocturnal NIV undergoing PR	Single-center RCT	HFNC vs. COT during PR	6MWT, Constant-load exercise testing	↔ 6MWD, ↓ Dyspnea, ↓ Fatigue

* Statistically, but not clinically significant. ^ Only vs. COT; the variation vs. NIV was not significant. ↑ = significantly increased vs. control group ($p < 0.05$); ↔ = no significant difference vs. control group ($p > 0.05$); ↓ = significantly reduced vs. control group ($p < 0.05$). Abbreviations: 6MWD, 6-minute walking distance; 6MWT, 6-minute walking test; BP, blood pressure; COPD, chronic obstructive pulmonary disease; COT, conventional oxygen therapy; CRF, chronic respiratory failure; FiO_2, fraction of inhaled oxygen; HFNC, high-flow nasal cannula; HR, heart rate; NIV, non-invasive ventilation; PaO_2, arterial partial pressure of oxygen; PR, pulmonary rehabilitation; RCT, randomized controlled clinical trial; RR, respiratory rate; SRGQ, Saint George's Respiratory Questionnaire; VM, venturi mask.

Table 2. Studies assessing HFNC in the clinical setting of ILDs and lung cancer.

Study	Subjects	Design	Intervention	Performance Tests	Main Findings
Chihara et al. (2022) [34]	15 IPF patients with CRF	Single-center RCT/crossover trial	HFNC at 50 L/min and FiO_2 100% vs. Oxygen at 6 L/min through nasal cannula during PR	6MWT, Constant-load exercise testing at 80% maximal capacity	↑ 6MWD, ↔ Endurance time, ↔ Dyspnea, ↔ HR, ↔ BP, ↔ RR
Harada et al. (2022) [39]	24 IPF patients with exertional dyspnea and desaturation	Randomized crossover trial	HFNC vs. VM at the same FiO_2	Constant-load exercise testing at 80% maximal capacity	↑ Endurance Time, ↑ SpO_2, ↓ Leg Fatigue, ↔ Dyspnea, ↔ HR, ↔ Comfort
Suzuki et al. (2020) [41]	20 fibrotic ILDs patients with mild exertional desaturation	Randomized crossover trial	HFNC vs. VM at the same FiO_2	Constant-load exercise testing	↔ Endurance Time, ↔ SpO_2, ↔ Dyspnea, ↔ HR, ↔ Comfort
Hui et al. (2021) [42]	45 non-hypoxemic patients with primary or secondary Lung Cancer	Single-center RCT	HFNC with FiO_2 100% vs. HFNC without O_2 vs. COT vs. Low-Flow Air at 2 L/min	Constant-load exercise testing	↑ Endurance Time $^+$, ↓ Dyspnea $^+$

$^+$ HFNC + FiO_2 100% vs. other groups. ↑ = significantly increased vs. control group ($p < 0.05$); ↔ = no significant difference vs. control group ($p > 0.05$); ↓ = significantly reduced vs. control group ($p < 0.05$). Abbreviations: 6MWD, 6-minute walking distance; 6MWT, 6-minute walking test; BP, blood pressure; COT, conventional oxygen therapy; CRF, chronic respiratory failure; HFNC, high-flow nasal cannula; HR, heart rate; ILDs, interstitial lung diseases; IPF, idiopathic pulmonary fibrosis; PR, pulmonary rehabilitation; SpO_2: peripheral oxygen saturation; RCT, randomized controlled clinical trial; RR, respiratory rate; VM, venturi mask.

High Flow Oxygen v. Usual Care

High flow nasal oxygen versus usual care in improving pulmonary rehabilitation outcomes of chronic obstructive pulmonary disease patients after an exacerbation - a pilot randomized controlled trial

Yingjuan Mokhttps://orcid.org/0000-0002-5421-8107[1,2], Jing Wen Foong[3], Hang Siang Wong[1,2], Amanda Soh[3], Shi Hua Tan[3], Poh Choo Tan[4], Bryan Peide Choo[5], and Keith Keat Huat Wong[6,7]

- Small study – 22 patients
- Not a statistically significant increase in 6 minute walk, CAT scores, HADS and FEV1

Time to exercise!

- Make sure patient is warmed up!
- Need oxygen flowing to all of those muscles
- Keep patient safe
  - No tripping hazards with oxygen tubing and tanks
- Educate patient on the goals of their exercise
- Make them aware of sign and symptoms of hypoxemia
  - ↑ heart rate
  - ↑ respiratory rate
  - ↓ SpO2

Time to exercise!

- Assess breathing patterns during exercise
  - No breath holding
- Start slow
  - Get a comfortable walking speed
  - Don’t let patient over-due it with other exercises
- Monitor SpO_2continuously
  - Especially at the beginning
  - Possibly continuously depending on disease process
- Progress exercise as tolerated
  - Break up exercise sessions:
  - Start slow and make sure patient feels successful!
  - For example, if end goal is 30 minutes, break into chunks: 10min, rest, 10 min, rest, 10 min, rest

Getting correct oxygen for home!

The RIsOTTO Study - Respiratory Care Journal (February 2021)

- Home Oxygen Evaluation by Respiratory Therapists in Patients Hospitalized for COPD Exacerbations: The RIsOTTO Study
- Respiratory Care-February 2021, VOL 66 No 2

- What is this study's background:
  - Majority of oxygen prescriptions for supplemental oxygen are written when patients are discharged to home from the hospital
  - The evaluation of these patients is inconsistent
  - RT's receive training in the evaluation and management of patients needing oxygen
  - Goal of this study was to estimate the frequency with which RT's evaluate the need for home oxygen in patients hospitalized for COPD exacerbations before discharge

The RIsOTTO Study - Respiratory Care Journal (February 2021)

- Method of the study was by questionnaire.
    - 611 respondents of which 490 were eligible for analysis
        - 58% of the RT's did resting evaluations
        - 43% evaluated with activity
        - 14% during sleep
        - 58% stated they were very familiar with CMS guidelines
        - Midwest states were more familiar with CMS guidelines and did activity assessments more often
        - Only 25% of the RT's had anything to do with what oxygen devices the patient had at home

    - Study Conclusion:
        - RT's do not consistently evaluate patients hospitalized for COPD exacerbations for home oxygen prior to discharge
        - A minority of RTs are involved in selecting home oxygen equipment
        - 42% of RTs who participated in the study were very familiar with CMS guidelines criteria for home oxygen

The Prescription

- Many patients don’t have the correct oxygen prescription
  - Initial prescription post discharge from the hospital
  - Only a “resting” oxygen level prescription
- We need to assure that we look at oxygen
  - At REST
  - With ACTIVITY
  - With SLEEP

The Prescription

The system at home

- Ask patient's what they have
  - Concentrators
  - Tanks
  - POCs

EVERYONE wants a POC

- Each device works differently
- No device goes beyond 3 lpm continuously
- POC's aren't for everyone!!!!

Devices they are using

- Nasal cannula
- High flow nasal cannula
- Oxymizer
- Masks

Getting the correct equipment for the patient at home

Conclusion

- Oxygen needs can be tricky for your patients
- Provide them the amount they need to exercise successfully and safely!
- Timely oxygen assessments are crucial!
- Remember activity in PR = activity at home.
  - Oxygen needs for home MUST be assessed and adjusted as well.
- Oxygen is the drug of choice for any PR program
  - Budget for it!