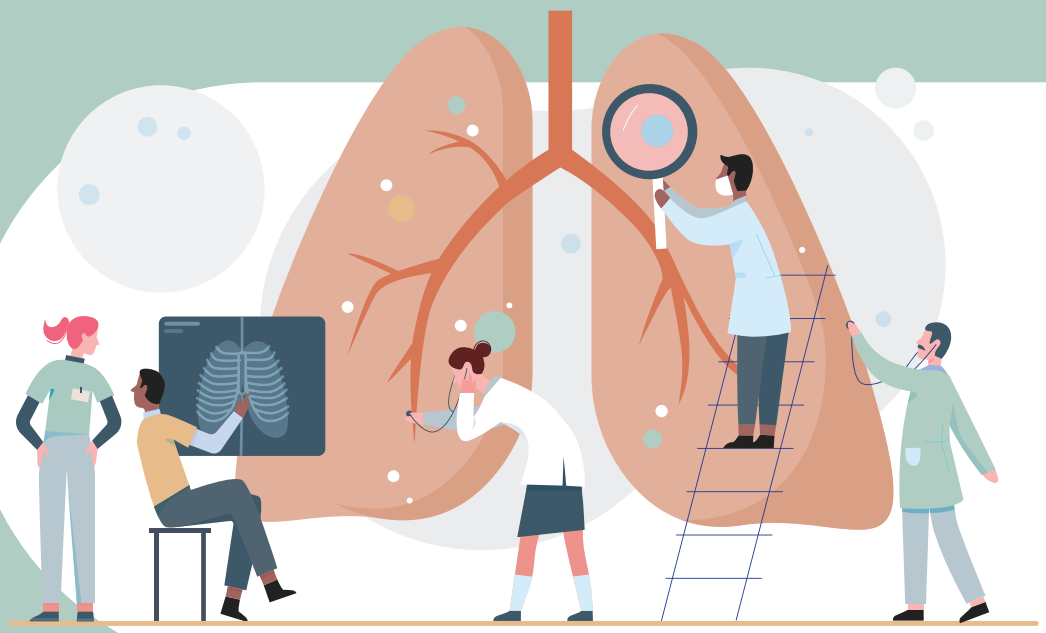
SPEECH PATHOLOGY TREATMENT GUIDE

for patients with co-occurring asthma and laryngeal dysfunction



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CHAPTER 1

BACKGROUND

Purpose of this document

Intended audience: Speech pathologists with clinical experience in diagnosing and treating laryngeal dysfunction disorders such as chronic cough (CC), inducible laryngeal obstruction (ILO) and muscle tension dysphonia (MTD). The information contained in this document may be familiar to some speech pathologists but has been included for completeness.

Aims:

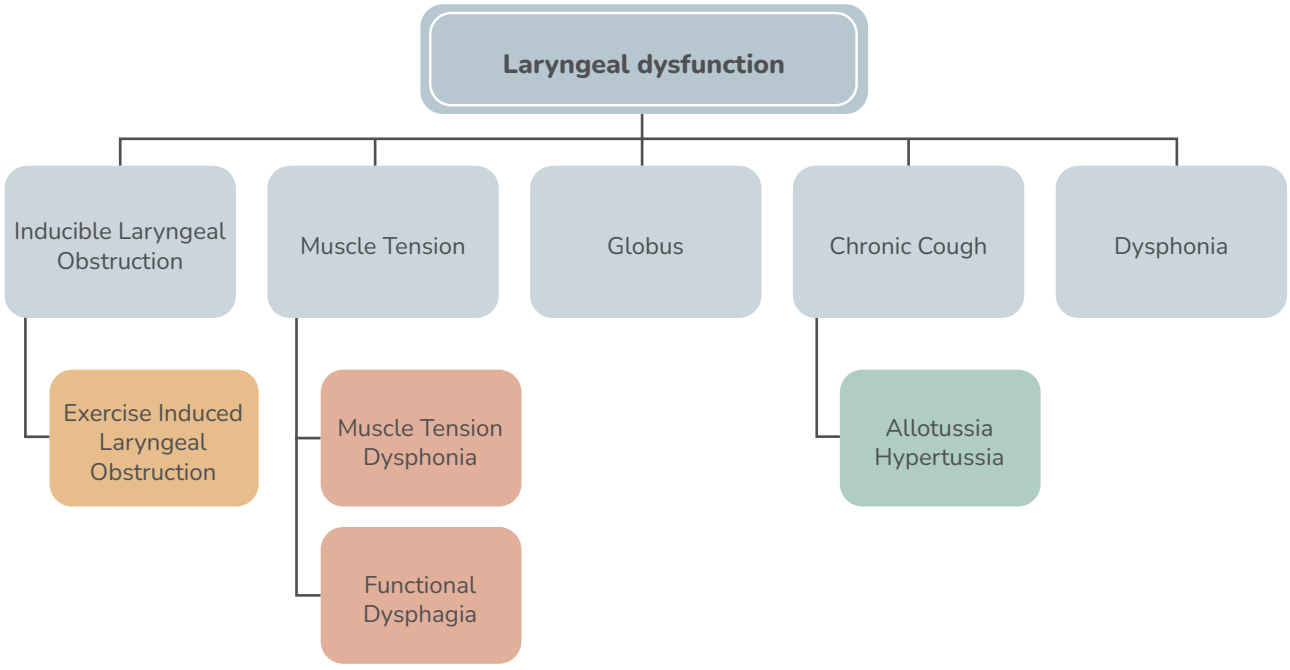
1) To outline a recommended approach for speech pathology assessment and treatment of patients who have laryngeal dysfunction with co-occurring asthma.

2) To enable speech pathologists to modify treatment plans for patients with laryngeal hypersensitivity syndromes and voice disorders with co-occurring asthma.

What is laryngeal dysfunction

Laryngeal dysfunction is an umbrella term to describe disorders of laryngeal function (figure 1).

Figure 1: Laryngeal dysfunction and its proposed components



What is Asthma?

Asthma is a common and serious chronic lung disease affecting people of all ages. It affects over 2.8 million Australians and is the leading cause of burden of disease in children[3]. People with asthma have narrowing of the small airways in response to triggers that can led to wheeze, shortness of breath, coughing and chest tightness that varies in time and intensity [4].

In 2020-2021 Asthma was the primary diagnosis for approximately 25,000 hospital admissions in Australia[5] , with 11% of the population having a diagnosis of asthma [6]. Globally, asthma affects over 262 million people[7]. Currently there is no single diagnostic test for asthma.

People with asthma often experience their symptoms at night, early in the morning or after activity. Asthma ranges in severity and asthma exacerbations can develop within a few minutes or more slowly over hours, days or even weeks. There is no cure for asthma, but it can be managed and treated.

Asthma and laryngeal dysfunction

There is significant symptom overlap between laryngeal dysfunction and asthma (table 1) and because of this, patients with both disorders may be misdiagnosed as having refractory asthma [8]. Symptoms can affect respiration, phonation, cough and laryngeal sensation [8] [9]. Patients with co-occurring asthma and laryngeal dysfunction have an increased symptom burden which can lead to increased healthcare costs, inappropriate medical treatment and poor adherence to medical and behavioural intervention, such as speech pathology treatment. Their diagnostic process can be disjointed, and they can be frustrated at the time taken for diagnosis and misunderstanding of their symptoms. While speech pathologists are familiar with laryngeal dysfunction disorders, they may need to employ a different approach for patients with co-existing asthma and laryngeal dysfunction.

Table 1: Similarities and differences of ILO and asthma

Inducible laryngeal obstruction	Asthma
Symptoms localised to the larynx	Symptoms localised to the chest
Does not involve the lower airways	Involves the lower small airways
Often (but not always) more difficulty breathing in	Often more difficulty breathing out
Sometimes a whistling sound when breathing in	Sometimes a wheeze when breathing out
Rapid resolution or improvement of symptoms	Gradual resolution or improvement of symptoms
Limited improvement to symptoms with usual dose asthma medications	Symptoms improve with asthma medications
Symptoms improve with speech pathology exercises	Symptoms do not resolve with speech pathology exercises
Neck, throat or upper chest tightness	Chest tightness

Dysfunctional breathing and laryngeal dysfunction

Dysfunctional breathing, also known as breathing pattern disorder, is defined as an altered pattern of breathing which could be structural, functional or have no organic cause and results in symptoms that might be chronic or intermittent for the patient [9] [10] [11]. Dysfunctional breathing may be present in the absence of other diseases and can co-occur with asthma and ILO and chronic cough. Up to 80% of asthma patients may also have dysfunctional breathing, although numbers vary greatly in the literature [12].

Dysfunctional breathing may be attributed to a primary location of movement (thoracic/clavicular breathing), breathing rate, breathing route (oral breathing) or atypical features such as stridor or breath holding. These may present on their own or in combination.

There is an overlap in symptoms between dysfunctional breathing and ILO, however further research is required to investigate the nature of this relationship in more detail. It is important to address dysfunctional breathing characteristics identified during assessment as part of a comprehensive speech pathology management.

CHAPTER 2

BIOMARKERS ASSOCIATED WITH ASTHMA

Biomarkers are measurable entities that provide insight into specific drivers of asthma, and treatments that are most likely to be effective. Biomarkers currently in widespread clinical use include blood eosinophil count, fraction of exhaled nitric oxide (FeNO), immunoglobulin E (IgE) levels and IgE levels when exposed to specific allergens. The clinical identification of biomarkers allows for recognition of different asthma phenotypes, identifying those at a higher risk of asthma attacks and the provision of personalised treatment options [13].

Blood Eosinophils

Eosinophils are a subtype of white blood cells. Blood eosinophils are easily measured through a full blood count (FBC), a commonly ordered blood test. Blood eosinophils are routinely used as a biomarker in clinical practice and trials alike. They strongly indicate which patients will have more asthma attacks, a faster decline in lung function and benefit from corticosteroids and biologic therapies [14-17].

Fractional Concentration of Exhaled Nitric Oxide (FeNO)

A FeNO test is a non-invasive test performed using a small portable device that measures the level of nitric oxide in an exhaled breath in parts per billion (ppb) [18]. FeNO levels increase as inflammation increases[19]. FeNO detects patients with type 2 driven airway inflammation and indicates those most likely to benefit from inhaled corticosteroids [20-22]. FeNO levels may provide information as to whether a patient is adhering to their prescribed inhaled corticosteroid (ICS) regime and can be valuable in considering ICS treatment requirements [23]. FeNO levels can be influenced by external variables such as air quality, smoking, sinus disease, diet, obesity, virus and infections, which needs to be considered in interpreting the results [23].

Sputum Eosinophils/Neutrophils

Eosinophils and neutrophils (both subtypes of white blood cells) are observed in a patient's sputum sample and expressed as a percentage of total cells. Their presence indicates that the patient might respond well to a particular biologic treatment. This test is time consuming, often poorly tolerated by patients and requires specialist staff trained in processing and analysis of samples, therefore it is typically unavailable outside of specialist centres and research settings [23].

Immunoglobulin E (IgE)

IgE is an antibody found in the blood. When a person is exposed to an allergen (such as pollen, dust mites, cat or dog dander or grass) an allergic reaction is initiated. Allergen specific IgE antibodies are produced. The IgE antibodies circulate in the blood and bind to receptors on immune cells (i.e. mast cells and basophils). When the allergen is encountered by the person again it binds to the IgE antibody already stuck on the surface of the immune cell, triggering degranulation (or disintegration) which releases a variety of inflammatory mediators that were in the immune cell (IL-4, IL-5, IL-13) into the person's blood stream. These mediators then travel through the body and cause inflammation in the airways which results in symptoms (i.e cough, wheeze, dyspnoea and chest tightness) [24].

CHAPTER 3

HETEROGENEITY IN ASTHMA

The recognition of asthma phenotypes (observable characteristics) and endotypes (clusters of biomarkers) has led to major advancements in the introduction of personalised treatment in asthma, with significantly improved patient outcomes. In this approach, patients are assessed to determine the drivers of their asthma, including the different contributing factors to their asthma which can be pulmonary, extrapulmonary or behavioural (known as treatable traits – see Chapter 6). One of the major advances in the treatment of asthma is the recognition that patients with certain endotypes benefit from biologic therapies, also called monoclonal antibodies (see Chapter 6). These are currently available on the Pharmaceutical Benefits Scheme (PBS) for severe asthma [25], although patients must meet strict requirements to be eligible.

Speech pathology management of a patient with asthma can be impacted by the type of asthma the patient has. Asthma can be subtyped by driving endotypes, presentations or clinical course, some of which are outlined below. Throughout the literature there are many different subtypes and ways of classifying asthma so only the most common are discussed here. Asthma endotypes can be broadly categorised into two main types of asthma: Type 2 high and Type 2 low and presentations and clinical course may co-occur.

Endotype

Type 2 high, also known as Type 2 or eosinophilic asthma: Type 2 inflammation is driven by eosinophils (white blood cells) and specific cytokines (messenger proteins that facilitate communication between cells, specifically responses to inflammation) which lead to airway inflammation, asthma exacerbations and decreased lung function. Type 2 high inflammation is identified in around 50% of patients with severe asthma [26]. Type 2 high asthma is very responsive to corticosteroids, including inhaled corticosteroids. In patients who require multiple courses of oral steroids for repeat asthma attacks, targeted treatments can be considered, such as biologics (see Chapter 6). These patients have increased eosinophils in their blood and sputum and some patients also have an increased FeNO.

Type 2 low: Type 2 low inflammation is characterised by the absence of eosinophils and type 2 inflammatory biomarkers. As such, traditional treatments such as inhaled corticosteroids, prednisolone, and biologics targeting type 2 inflammation are not helpful [27]. New biologic targets have been developed, such as tezepelumab, targeting thymic stromal lymphopoietin (see chapter 6, table 5). Type 2 low asthma is an area of ongoing research.

Allergic asthma (atopic asthma): Most common in childhood, affecting 70-90% of children and up to 50% of adults with asthma [28]. It is triggered when the patient encounters a particular allergen. It is often associated with family history of other allergic disease such as allergic rhinitis, eczema or food allergies [26]. Around 80% of people diagnosed with asthma have positive allergen tests [29].

Non allergic asthma (non-atopic asthma): These patients have asthma that is not associated with any allergy or allergen trigger. They can be triggered by other factors such as a virus, exercise or weather conditions. It often involves neutrophilic inflammation, rather than eosinophils, both of which are subtypes of white blood cells.

Asthma presentation

Cough variant asthma: Cough is the primary symptom with relatively little wheeze and shortness of breath. Variability in lung function test results is required for this diagnosis [30].

Exercise induced asthma: May also be labelled as exercise-induced bronchoconstriction (EIB) however EIB can occur in those without asthma. Symptoms and airway narrowing are triggered by intense physical activity. Symptoms peak after exercise. In contrast to ILO, symptoms tend to persist following the cessation of the physical activity [31].

Work related asthma: Includes:

- Work exacerbated asthma – asthma worsened by workplace conditions and/or exposures which can be new onset or on the background of pre-existing asthma [32].
- Occupational asthma - typically new onset caused by workplace exposure to airborne substances (such as chemicals, dust, fumes, particles etc). Symptoms improve when the patient is removed from the triggers, which can require them to change their role or location in the workplace [32].

Nocturnal asthma: Worsening asthma symptoms at night that are likely to interfere with sleep. The body's circadian rhythm affects hormones such as melatonin, cortisol and adrenaline. Contributing factors include body positioning, mucus production, sinus drainage, reflux, and exposure to triggers during sleep [33].

Adult onset, also known as late onset asthma: Asthma that develops for the first time in adulthood. It is often more poorly controlled and associated with worse lung function [34].

Clinical Course

Uncontrolled asthma: Poor symptom control (increased reliever use, night waking due to asthma, activity limitation) and/or frequent exacerbations. Approximately 45% of those with asthma in Australia have uncontrolled symptoms [23].

Difficult to treat asthma: Uncontrolled asthma (as defined above) with significant symptom burden despite intensive medical treatments [23].

Severe asthma: It is suspected that 3-10% of people with asthma have a severe form [23]. Severe asthma is defined as asthma that remains uncontrolled even though the patient is adhering to the maximal therapeutic dose of medication [23]. Severe asthma is responsible for a large amount of the mortality and morbidity in the asthma population [25].

Brittle asthma: A severe type of asthma that is known to be unpredictable with potentially life-threatening attacks. The term "brittle asthma" is older and not commonly used [35].

CHAPTER 4

ASTHMA ASSESSMENT

Pulmonary function tests

Pulmonary function tests measure the ventilatory capacity of the chest and lungs and their ability to move gas in and out of the alveoli. Pulmonary function tests provide an objective measurement of the extent of impairment and is helpful in confirming a diagnosis of asthma. Features of the pulmonary function tests, such as the flow volume loops, might raise the suspicion of ILO[36].

Spirometry

Spirometry is a type of pulmonary function test that uses a machine called a spirometer to measure the volume of air expelled in one breath with full lungs, and the speed at which the air is expelled. The patient's results are compared to normal reference values, based on healthy individuals with normal lung function matched for sex, age, height and ethnicity. Bronchodilators are withheld before the test. Reversibility, also known as bronchodilator responsiveness, is assessed by completing spirometry before and after providing a rapid acting medication (SABA) to assess whether there is any improvement of their results. These measures are often denoted as "Pre BD/Pre Bronchodilator" and "Post BD/Post Bronchodilator" on a spirometry report [36] (see examples below).

Table 2 breaks down some of the key measures obtained during spirometry and their normative values.

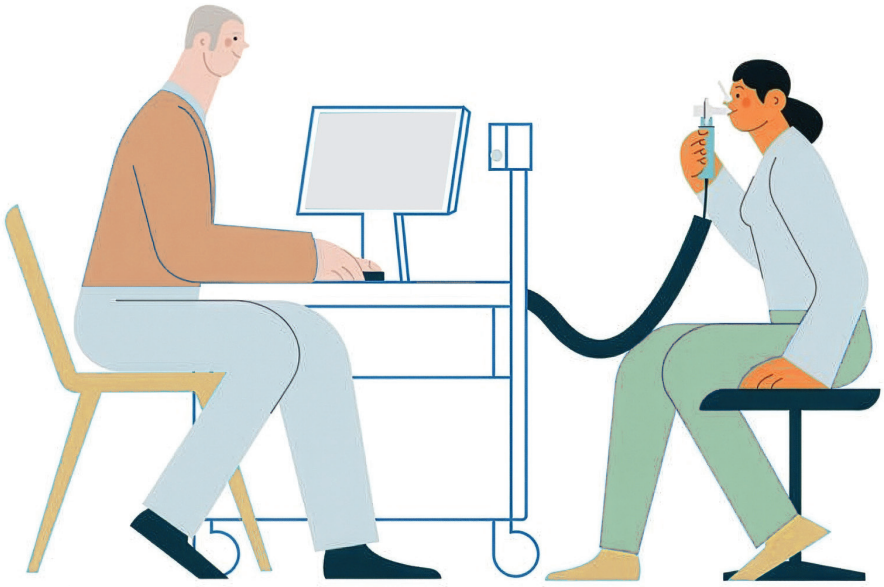


Table 2: Normative values for pulmonary function testing [36]

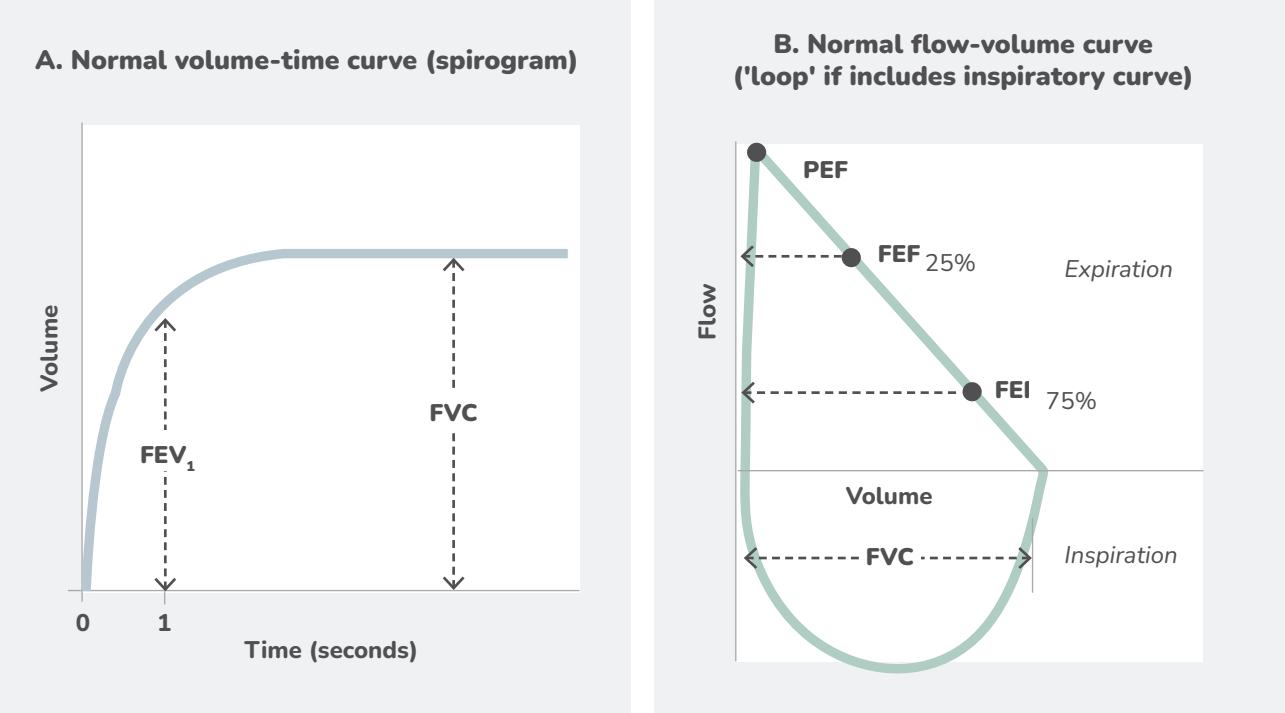
Measure	Obtained via	Definition and clinical interpretation	Normal range
FEV_1	**Spirometry**	**Forced expired volume in one second.** The volume expired in the first second of maximal expiration after a maximal inspiration. This measures the severity of airflow obstruction.	≥80% of predicted
FVC	**Spirometry**	**Forced vital capacity.** The maximum volume of air that can be exhaled during a forced expiratory manoeuvre after complete inspiration. Provides information on lung capacity.	>80% of predicted
FER (or FEV_1/FVC)	**Spirometry**	**Forced expiratory ratio.** FEV_1 expressed as a percentage or fraction of the FVC. It represents the percent of the lung capacity (FVC) that can be exhaled in one second. Similar to abnormality of the FEV_1 if the FEV_1/FVC is below the normal range it may be indicative of obstructive lung disease.	>70 % of predicted
FIF50 (or MIF)	**Spirometry**	**Forced inspiratory flow at 50% of the vital capacity** This value is often reported in pulmonary function test reports. A lower FIF50 indicates reduced inspiratory flow and can be indicative of ILO.	>100L/min
TLCO also known as a gas transfer or DLCO		**Transfer Factor of the lung for Carbon Monoxide** This test indirectly measures the movement of oxygen from the lungs to the bloodstream. To perform a gas transfer test the patient is asked to breathe an inert gas such as helium and carbon monoxide, hold their breath and exhale [37].	≥80% of predicted

Flow volume loops

Flow volume loops measure airflow rate against lung volume and provide a graphic representation of the patient's spirometry performance during inspiration and expiration. The overall shape of the flow volume loop aids in interpreting the spirometry results. The airflow when completing forced expiration is affected by airway resistance, respiratory muscle strength and elastic recoil of lung tissue. The expiratory flow can be limited by airway thickening and therefore narrowing of the bronchial lumen. This is captured visually by the flow volume loop above the x axis and can be indicative of asthma. If the inspiratory flow, captured visually under the x axis, is abnormal but expiratory flow is normal, ILO should be considered. [36].

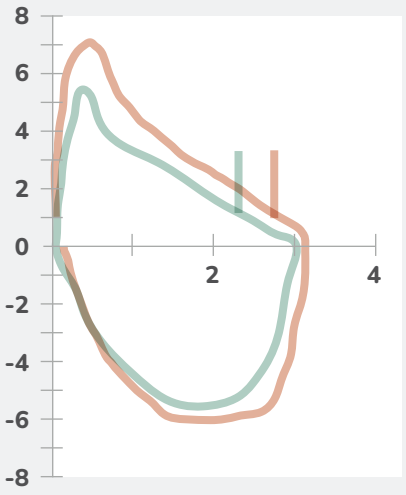
Figure 2 demonstrates a normal spirometry tracing and flow volume loop with measures labelled.

Figure 2: Spirometry tracing of healthy individual with measurements [36]

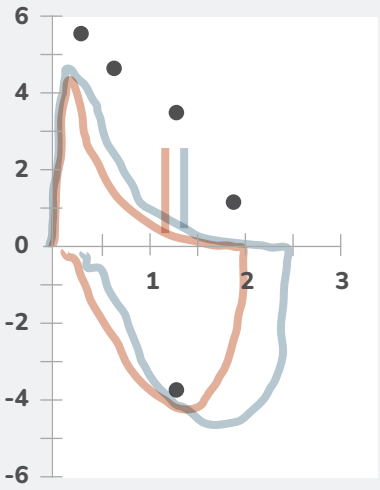


FEV1: forced expiratory volume in one second; FVC: forced vital capacity; FEF25%: forced expiratory flow at the point where 25% of FVC has been expired; FEF75%: forced expiratory flow at the point where 75% of FVC has been expired.

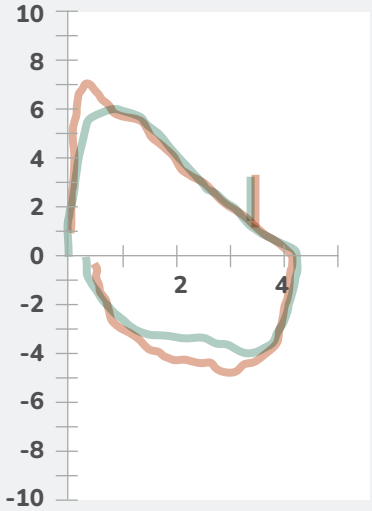
Figure 2: Spirometry tracing of healthy individual with measurements [36]



Normal Inspiratory and Expiratory Flow. A normal flow volume loop has a rapid initial exhalation phase to the peak expiratory flow (here it is 7) with a gradual decline in flow back towards zero. The inspiratory portion of the loop is a deep curve plotted on the negative portion of the flow axis. Inspiratory data in the flow volume loop is often overlooked.



Normal Inspiratory Flow with Reduced Expiratory Flow The expiratory flow loops are scooped and drop towards the x axis after 1 second or so compared to the loops in Figure 4.1. In asthma and expiratory airflow obstruction, there is a characteristic concave shape of the expiratory limb of the flow volume loop while the inspiratory limb remains normal. As this is an issue with expiration, patients with asthma may describe more difficulty breathing out rather than in.



Normal Expiratory Flow with Reduced Inspiratory Flow There is a flattening of the usual deep inspiratory curve while the expiratory portion of the loop appears relatively normal. This pattern may be seen in those with ILO.

Obstructive vs Restrictive lung disease

Lung diseases are often categorised into obstructive, restrictive or mixed pattern [4].

Obstructive lung diseases impede air flow out of the lungs which leads to air trapping. An obstructive pattern is seen in asthma, COPD, bronchiectasis and cystic fibrosis. The patient is unable to exhale quickly due to airway narrowing, inflammation, contraction or collapse. An obstructive pattern can be transient or permanent [36]. In a patient with an obstructive lung disease, the FER (or FEV_1/FVC) will be low, and their flow volume loop will have a concave ("scooped") appearance. FEV1% predicted classifies severity of the obstruction. Bronchodilator response is used to determine whether the patient's obstruction is reversible or non-reversible. For example, in asthma, bronchospasm is alleviated by bronchodilator medications, however in chronic obstructive pulmonary disease (COPD) airway narrowing is fixed and therefore there would be minimal or no response to bronchodilation medication.

Restrictive lung diseases limit the lungs movement and therefore their ability to expand fully and inhale. A restrictive pattern is seen in those with interstitial lung disease, weak respiratory muscles, rib deformities, obesity, and pulmonary fibrosis [36]. In a patient with a restrictive lung disease, there is restricted lung volume which is characterised by a normal or high FER (or FEV_1/FVC) and a low FVC. The flow volume loop is often tall and narrow, reflecting a normal ability to get air out in one second (FEV_1), but a reduced expiratory capacity overall (FVC).

Airway challenge testing

Airway challenge tests, also known as bronchial provocation tests or hyper responsiveness tests, are designed to assess the response of the airway to various stimuli. Airway challenge tests can measure both inspiratory and expiratory function and use different provocation methods to trigger airway narrowing. The patient inhales gradually increasing doses of a provocation agent or in the case of exercise completes activity of increasing intensity and their symptoms are observed. There are a variety of provocation agents that may be used. Hypertonic saline and exercise may be more suitable when investigating possible ILO and EILO. Histamine, methacholine, and mannitol are all provocation agents that are more suited to the assessment of asthma. When completing an airway challenge test, spirometry is performed at baseline and repeated at regular intervals after each increasing dose. Results are compared to baseline measures.

Mannitol is commonly used for bronchial provocation testing. Mannitol is a dry powder administered via an Osmohaler device. 60 seconds after delivery of mannitol spirometry is repeated and results are compared to baseline measures. A mannitol challenge test is considered positive if there is a decrease of 15% or more from baseline FEV_1 in response to the cumulative total dose, or a 10% decrease in FEV_1 between two consecutive mannitol doses [38]. More detail regarding airway challenge test measures is provided in table 3.

Table 3: Airway Challenge Test Interpretation [38]

Measure	Definition	Significant fall	Example
% fall in FEV_1	Measure of FEV_1 decrease from baseline after administration of provocation agent	≥ 15% decrease from the baseline or a 10% drop in sequential doses	If baseline FEV_1 = 3.04L and FEV_1 after one dose of provocation agent was 2.95L, this is a 3% fall from baseline measure and hence does not indicate bronchial hyperresponsiveness.
Clinical significance			
A fall of 15% or more is consistent with bronchial hyperresponsiveness and may be indicative of asthma. Bronchial hyperresponsiveness is currently defined as an increase in sensitivity to a wide variety of airway narrowing stimuli.			
% fall in FIF50	This is a measure of FIF50 after administration of provocation agent compared to baseline	≥ 20-25%	If baseline FIF50 = 4.1L and FIF50 after one dose of provocation agent was 2.76L, this is a 43% fall from baseline which may be indicative of glottal constriction.
Clinical significance			
A fall in FIF50 of 20%-25% or more during provocation challenge has been correlated with glottal constriction and may be an associated feature in ILO. However, it is less accurate for confirmation than direct laryngoscopy. When looking at the fall across the various time points of the test consider the size of the drop (e.g. only report the largest fall) but also consider whether this was a one-off fall at a certain time point or if there was consistent fall at each time point (aka dose). Suggest report findings as: "There was a 56% fall in FIF50 at the 2-minute dose and this was the only positive fall across the test" or "There were multiple falls in FIF50 over various doses, none of which were particularly significant".			

CHAPTER 5

REPORTING OF ASTHMA TESTS

Reporting of pulmonary function and airway challenge tests

Pulmonary function test reports will differ in format between respiratory laboratories. In a report, the percentage predicted reference value compares the patient's results to normative values for many healthy individuals who have the same sex, age and height, ethnicity and smoking status. To find the reference value on your spirometry report, look for the column marked "normal range" "reference" or "predicted" value.

In figure 4, the maximal fall in FEV_1 was 12% (red circle) which is within the normal range (of ≥ 15% decrease from the baseline) and unlikely to be suggestive of asthma. The maximal fall in MIF (also known as FIF50) was 35% (yellow circle). This fall in MIF is outside the normal range (of ≥ 20-25%) which might be suggestive of vocal cord dysfunction.

Figure 4: Results from testing database hypertonic saline challenge test

Figure 5 shows a more detailed example of an airway challenge test report. The baseline FEV_1 and FVC were 100% and 107% predicted respectively which is in the normal range. The FER was also within the normal range at 74%. The fall in FEV_1 was 12% which is within the normal range and the fall in FIF 50 was 28% which is outside the normal range. This result is not suggestive of asthma but does indicate possible laryngeal dysfunction.

Figure 5: Example of Hypertonic Saline Provocation Test report

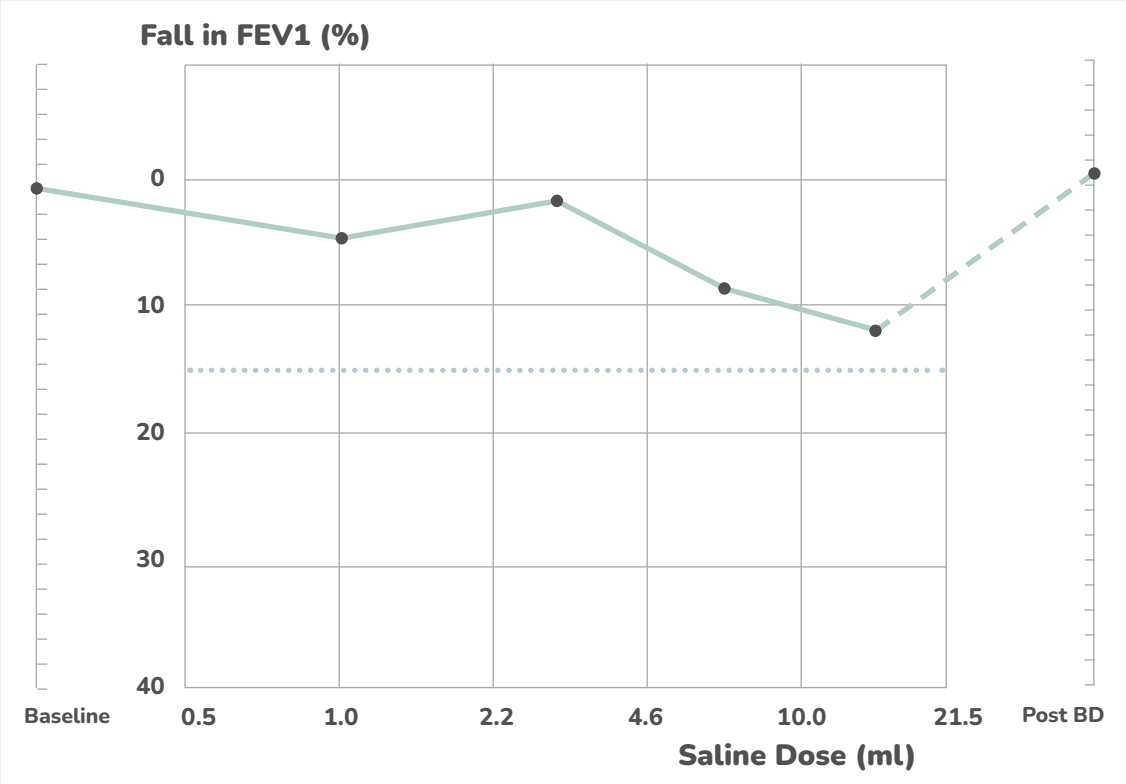
Height (cm): 178
Weight (kg): 88.4
BMI (kg/m/m): 27.9

Smoking Hx: Current 2/day
Pack years: 9
Last BD: Nil

Clinical Note: Reduced exercise tolerance, SOB, dizziness during exercise. 6q duplication disorder.

HYPERTONIC SALINE PROVOCATION TEST

BASELINE SPIROMETRY		Normal Range	Baseline (% pred.)		PD15 > 15.19 ml
FEV1	L BTPS	> 2.61	3.34	(100%)	
FVC	L BTPS	> 3.31	4.53	(107%)	
FER	%	> 69	74%		
MIF	L/sec		7.04		



Technical Comment: Patient requested to stop - Severe scratchy sensation at the back of the throat along with a hoarse voice and tickle. Final Dose MIF dropped 28% from baseline. (MW)

REPORT
Bronchial provocation for bronchial hyper-reactivity was ceased prematurely due to patient request but was negative at a dose of 15.19 mls of hypertonic saline. There was evidence of UAW hyper-reactivity with a significant fall in FIF50 in the final two doses.

Figure 5: Example of Hypertonic Saline Provocation Test report

Fraction Exhaled Nitric Oxide

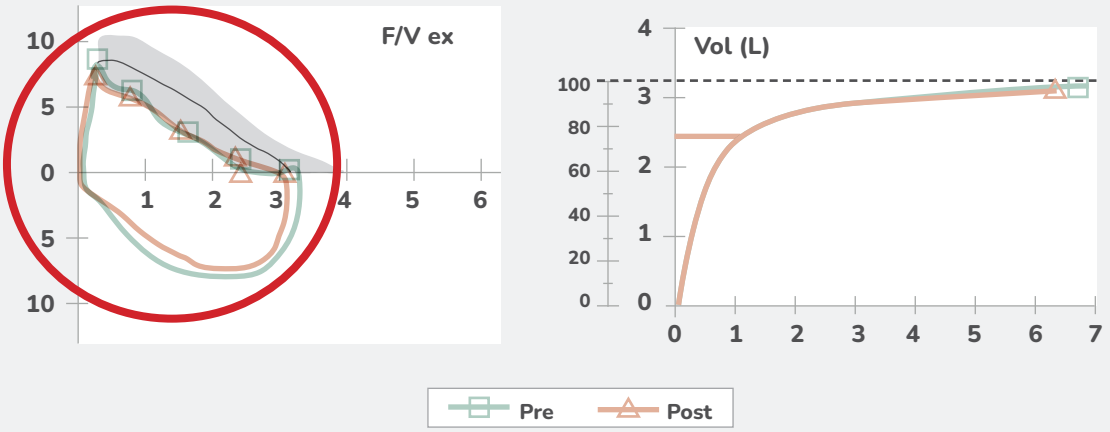
FeNO: 12 ppb (Upper limit of normal range (2SD) 41 ppb.)

Spirometry

	Pred	LLN	Pre BD	%Ref	Post BD	%Ref	%Chg
FEV1 L	2.92	2.30	2.42	**83**	2.42	83	0
FVC L	3.38	2.67	3.16	**94**	3.06	91	-3
FEV1/FVC %	82	72	**77**	93	79	85	3

Bronchial Challenge

	Ref	Pre BD	30 sec	1 min	2 min	4 min	min	min	Post...
FEV1 L	2.92	2.42	2.31	2.33	2.23	2.20	2.06		2.42
FEV1 (Chg%Pre)		0	-4	-4	-8	-9	**-15**		0
FVC L	3.38	3.16	3.09	3.07	2.90	2.93	2.75		3.08
FVC (Chg%Pre)		0	-2	-3	-8	-7	-23		-3
FIF50 L/s		5.69	5.69	4.97	4.24	4.99	4.11		4.94
FIF50 (Chg%Pre)		0	0	-13	-25	-12	**-28**		-13



CHAPTER 6

MEDICAL TREATMENT

Treatable Traits

Treatable Traits is a method of performing multidimensional assessments examining pulmonary, extrapulmonary and behavioural factors that are contributing to a patient's symptoms. A trait is a factor that can be measured, is clinically relevant and treatable [39]. The recognition of the particular traits of an individual allows for the implementation of personalised treatment (e.g., medicines, speech pathology, behavioural interventions etc) according to these traits. Figure 7 from Clark et al (2017) details the frequency of the most common traits observed in patients with asthma [40]. Further information regarding treatable traits can be found at www.treatabletraits.org.au

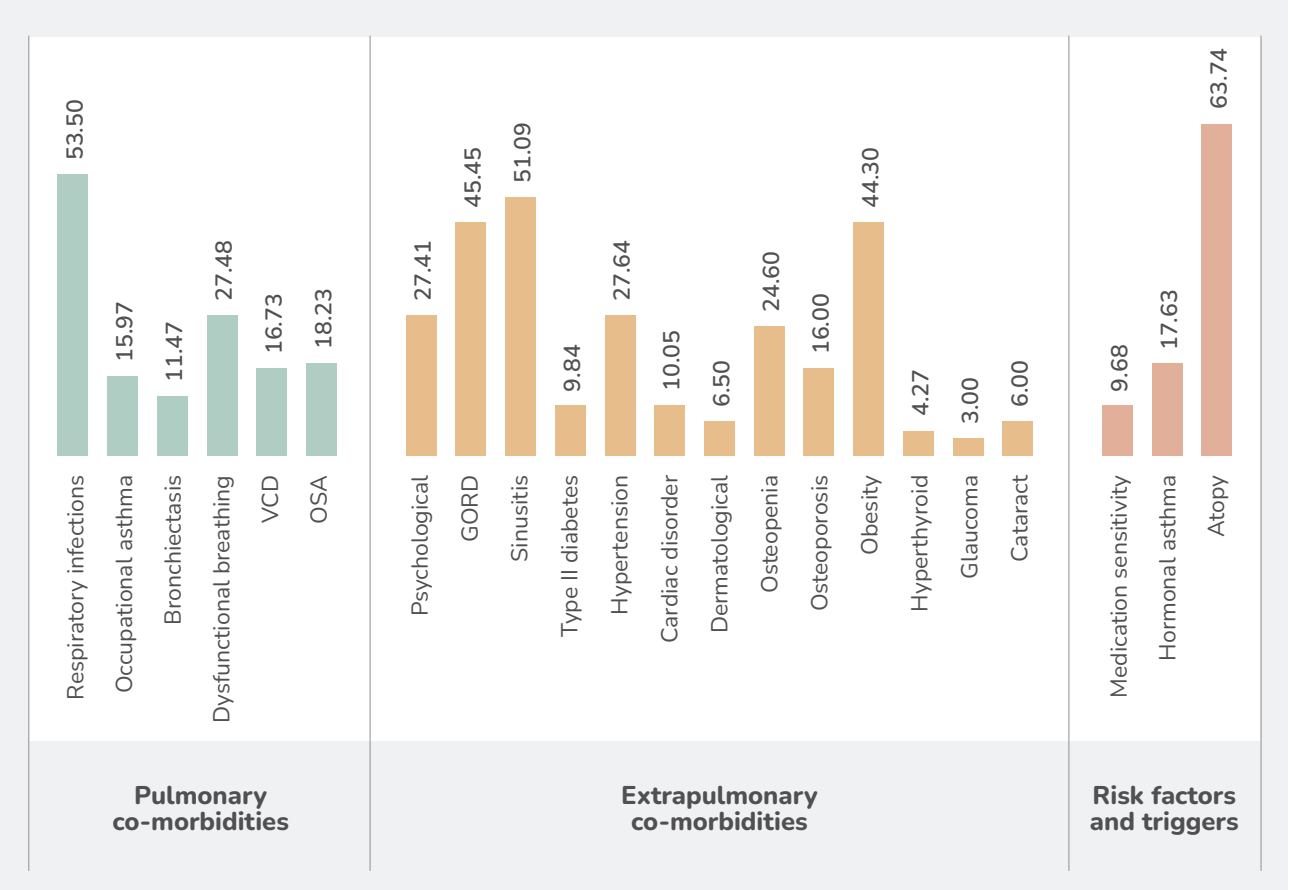
Comorbidities

The presence of comorbidities are associated with worse asthma outcomes for patients [41]. Comorbid chronic health conditions in asthma can be both pulmonary and extrapulmonary and include obesity, allergic rhinitis, obstructive sleep apnoea, nasal polyps, ILO and gastroesophageal reflux disease (GORD). Of the 2.7 million Australians with asthma, based on self-reported data from the 2017–18 National Health Survey [6], around 1.6 million people also had one or more of the following: arthritis, back problems, cancer, COPD, diabetes, heart disease, vascular disease, stroke, kidney disease, mental/behavioural conditions, osteoporosis [5]. Some comorbidities, particularly dysfunctional breathing and ILO can be misdiagnosed or undiagnosed [42].

Treatable traits vs comorbidities

Comorbidities are medical conditions that exist concurrently with a primary diagnosis, in this case, asthma. Treatable traits are any characteristics, including comorbidities, risk factors or self-management skills, that are clinically relevant, identifiable and measurable.

Figure 7: Co-morbidity prevalence shown as average percentage [40]



Medications for Asthma

There are a wide variety of medications that are used individually or in combination to treat the symptoms of asthma. These medications are outlined in table 4.

Reliever medications provide rapid relief from asthma symptoms and are used on an as needed basis. They quickly relax the muscles around the bronchi to improve air flow. Reliever medications should be used at the lowest dose and frequency required and if are being used more than recommended, a medication review by a doctor is recommended. Historically, salbutamol (brand name Ventolin) was commonly prescribed, however data demonstrating that it did not reduce mortality has led to the implantation of an inhaled ICS and formoterol, a rapid onset long-acting beta agonist as the first line for reliever medication. It is important to be aware that people can purchase salbutamol over the counter without a prescription or proof of asthma diagnosis. Use of short acting reliever medications in isolation, even for mild asthma, has not been recommended in the latest Global Initiative for Asthma (GINA) guidelines [43].

Frequent use of reliever medication with persistent symptoms could also be indicative of other diagnosis such as ILO or dysfunctional breathing and may be the referral reason for speech pathology assessment.

Low dose OCS may be used for short term management of uncontrolled asthma however OCS are associated with increased side effect risks including bone density loss (increasing long term risk of osteoporosis), adrenal suppression, mood disturbances and more [43] [44]. OCS therefore are only typically used for treatment of an acute asthma attack or for maintenance and only when essential. In the event patients are requiring multiple courses of oral corticosteroids, they should receive a multidimensional assessment of their asthma, and advanced therapies like biologics should be considered.

The ability to create antibodies targeting specific targets has greatly increased treatment options including rheumatoid arthritis, dermatitis and cancers. It has allowed specific treatment of asthma endotypes (table 5).

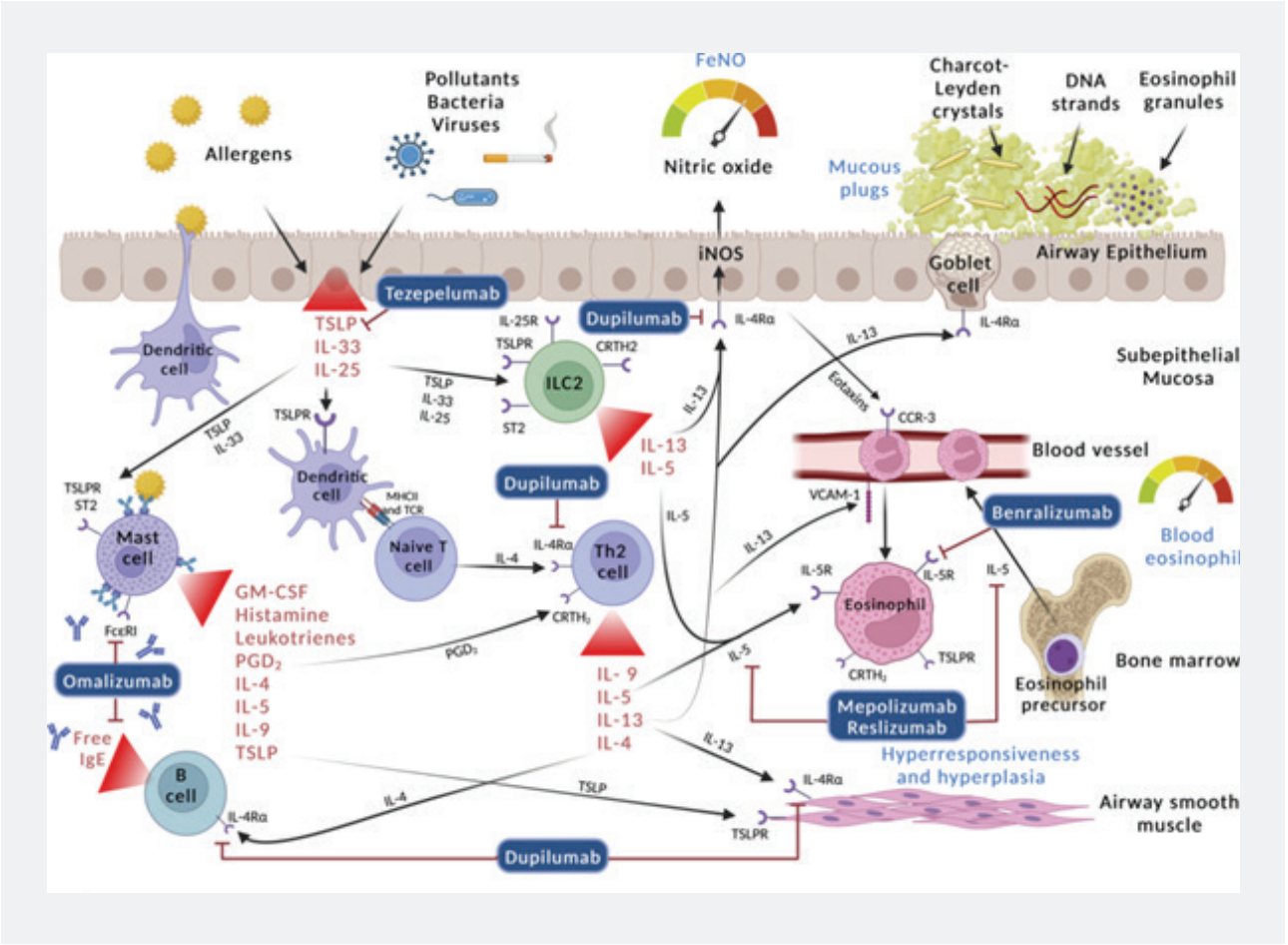
Table 4: Asthma medication types

Inhalers	
Inhaled corticosteroids (ICS)	• Typically end in –ide or –one • Anti-inflammatory • Can be taken as a reliever if needed infrequently, as maintenance treatment, or both • Generally, there are no serious side effects for long term ICS use. Sometimes there is some mouth or throat irritation from incorrect use of puffer or spacer device or poor oral hygiene post inhalation.
Long-acting beta agonist (LABA)	• Typically end in –erol • Bronchodilator used to open the airway and reduce the swelling • Impact can last for around 12 hours • Taken only in combination with ICS • **ICS/LABA combinations are now being used as relivers and maintenance**
Leukotriene modifiers	• Typically end in –ast • Blocks leukotrienes (which increase inflammation)
Combination inhalers	• Multiple combinations available of inhaled corticosteroids (ICS), inhaled beta agonists (LABA) and long-acting muscarinic antagonists (LAMA)
Short acting beta agonist (SABA)	• Previously prescribed for short term relief but is now **SABA monotherapy is now strongly discouraged** • Include Salbutamol (known as Ventolin) and Turbutaline • Not for daily use • Work in minutes and last for 4-6 hours • Relaxes the airways • Specialists are moving away from SABA monotherapy, as it does not reduce mortality
Asthma exacerbations	
Oral corticosteroids (OCS)	• Typically end in –one (best known is Prednisone) • For limited use (i.e. when experiencing a significant exacerbation) • There are many serious long term health side effects of prolonged use
Add on therapies	
Biologics (monoclonal antibodies) (see table 5 for more details)	• Typically end in -umab • These target specific cells or antibodies to reduce inflammation. • Are provided by regular injection (every 2-4-6 weeks) or IV • Typically taken in conjunction with other Asthma medications • Patient requires blood work to help determine treatment
Long acting muscarinic antagonists (LAMA)	• Bronchodilator • Typically end in -ium • Sometimes used instead of a LABA if it has been ineffective (although LABA is preferred) • Used in combination with ICS +/- LABA
Anti-fungal treatment	• Itraconazole • Might be helpful if the patient has severe sensitivity to specific fungi or allergic bronchopulmonary aspergillosis (ABPA) • Risk of adrenal suppression when interacting with ICS and other medications
Macrolide antibiotics	• Azithromycin • Has anti-bacterial and anti-inflammatory properties • Ongoing research in this area but appears to be helpful for reducing exacerbations

Table 5: Summary of monoclonal antibodies (biologicals)[45] [46]

Biologic	Brand name	Target	Mechanism	Indication	Dose
Omalizumab	Xolair	Anti-IgE	Binds to free IgE and prevents it from attaching to mast cells and basophils therefore reducing allergic inflammation	Moderate-severe allergic asthma already treated with maximal therapy with meeting criteria of increased IgE levels and positive allergen specific IgE. May also be effective in treating uticaria or chronic rhinosinusitis with polyps	First approved biologic for asthma; subcutaneous injection every 2–4 weeks
Mepolizumab	Nucala	Anti-IL-5	Blocks IL-5 binding to its receptor which reduces eosinophil production and survival	Severe eosinophilic asthma experiencing persistent exacerbations despite optimal treatment and meeting criteria of increased blood or sputum eosinophils. May also be effective in treating chronic rhinosinusitis with polyps	Subcutaneous injection every 4 weeks
Reslizumab	Cinqair	Anti-IL-5	Blocks IL-5 binding to its receptor which reduces eosinophil production and survival	Severe eosinophilic asthma experiencing persistent exacerbations despite optimal treatment and meeting criteria of increased blood or sputum eosinophils.	Used less often due to IV route every 4 weeks.
Benralizumab	Fasenra	Anti-IL-5 receptor on surface of eosinophils and basophils	Blocks IL-5 which is responsible for growth, differentiation, recruitment, activation and survival of eosinophils resulting in reduction or eosinophils.	Severe eosinophilic asthma experiencing persistent exacerbations despite optimal treatment and meeting criteria of increased blood or sputum eosinophils	Subcutaneous injection every 4 weeks for the first 3 doses then every 8 weeks.
Dupilumab	Dupizent	Anti-IL-4 receptor α	Blocks IL-4 and IL-13 signalling which in turn reduces type-2 inflammation	Severe eosinophilic or allergic asthma, also effective in atopic dermatitis or chronic rhinosinusitis with polyps	Subcutaneous injection every 2–4 weeks
Tezepelumab	Tezspire	TSLP (thymic stromal lymphopoietin)	Blocks TSLP (an upstream cytokine that activates multiple inflammatory pathways)	Severe asthma regardless of phenotype (eosinophilic or not)	Newest option in development. Broadest indication. One dose every 4 weeks.

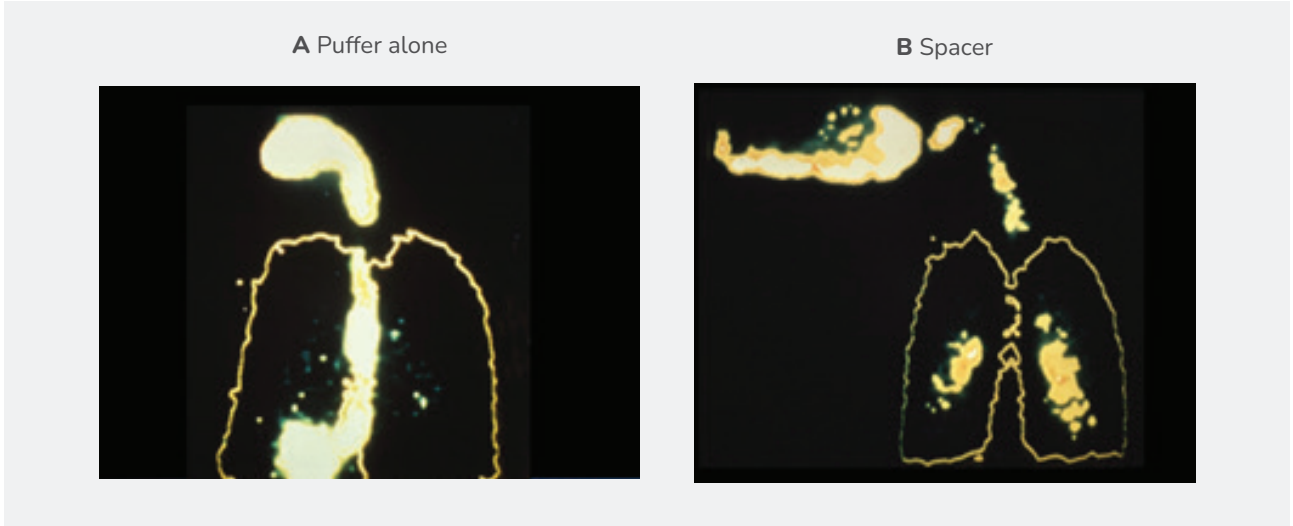
Figure 8: Biologics and their pathway to address type 2 inflammation [47]



Spacers

A spacer connects to a puffer and holds the medication, so the patient can breathe the medication in slowly and deeply. Spacers are recommended to improve the amount of asthma medication that reaches the small airways of the lungs (figure 9).

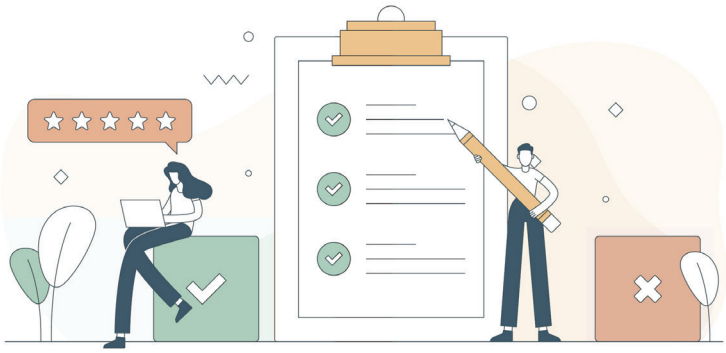
Figure 9: Inhaler technique: How using a spacer improves medication dissemination into the small airways



CHAPTER 7

SPEECH PATHOLOGY ASSESSMENT

Questionnaires



Questionnaires completed by the patient measure the nature and severity of symptoms and monitor progress during therapy. Questionnaires can be completed prior to each appointment (e.g. administered online or given in the waiting room) to monitor severity and change at each session. Questionnaires commonly used in voice and upper airway disorders may be familiar to speech pathologists and include the Leicester Cough Questionnaire [48], Laryngeal Hypersensitivity Questionnaire [49], Vocal Cord Dysfunction Questionnaire [50], Exercise-Induced Laryngeal Obstruction Dyspnea Index [51], Dyspnoea Index [52], Hospital Anxiety and Depression Scale [53], Cough Severity Index [54], Pittsburgh VCD Index [55], Voice Symptom Scale [56], Voice Related Quality of Life [57] and Voice Handicap Index [58]. It is not necessary to administer all these questionnaires to each patient but may be useful to administer one questionnaire in each domain (e.g. voice, cough, breathing) at the initial assessment, and then repeat one or two relevant questionnaires at subsequent appointments.

The Asthma Control Questionnaire (ACQ) [59] may be less familiar to speech pathologists. It is a simple questionnaire which is used to measure asthma control. It contains five questions about current asthma symptoms. Scores on the ACQ-5 range between 0 (totally controlled) and 5 (severely uncontrolled). Scores of >1.5 indicate poorly controlled asthma and a change of >0.5 is clinically significant. The ACQ-7 is the original version which includes two additional questions, about bronchodilator use and FEV1% measurement however sometimes these measures are not readily available, therefore the ACQ-5 may be more appropriate. The ACQ can be helpful in differentiating between asthma and ILO symptoms however patients may have elevated ACQ scores if they misattribute symptoms of ILO to asthma.

The Nijmegen Questionnaire [60] is a 16 item assessment for the presence of hyperventilation. It does not identify the presence of dysfunctional breathing specifically, but despite this, it is the most used diagnostic tool in the dysfunctional breathing population [61]. A score of >23 is suggestive of the presence of hyperventilation syndrome and may indicate to the clinician that further assessment of breathing patterns is warranted.

Table 6 provides links to the original articles for some of the most used questionnaires. Press ctrl and click the underlined text to access. Some articles and questionnaires are free to access, and some require payment to access. Permission to use the questionnaire may need to be requested from the authors. Many of the questionnaire forms can be found for free by completing a Google search.

Table 6: Questionnaires

Cough	
Leicester Cough Questionnaire (LCQ) [48]	Development of a symptom specific health status measure for patients with chronic cough: Leicester Cough Questionnaire (LCQ) | Thorax (bmj.com)
Cough Severity Index (CSI) [54]	Development and validation of the cough severity index: a severity index for chronic cough related to the upper airway - PubMed (nih.gov)
Laryngeal Hypersensitivity	
Laryngeal Hypersensitivity Questionnaire (LHQ) [49]	Development and validation of the Newcastle laryngeal hypersensitivity questionnaire - PMC (nih.gov)
Vocal cord dysfunction	
Vocal Cord Dysfunction Questionnaire (VCD-Q)[50]	The VCDQ--a Questionnaire for symptom monitoring in vocal cord dysfunction - PubMed (nih.gov)
Pittsburgh VCD Index [55]	A novel scoring system to distinguish vocal cord dysfunction from asthma - PubMed (nih.gov)
Exercise-Induced Laryngeal Obstruction Dyspnoea Index (EILODI)[51]	Development and validation of the Exercise-Induced Laryngeal Obstruction Dyspnea Index (EILODI) - PubMed
Breathlessness	
Dyspnoea Index (DI) [52]	Development and validation of the Dyspnoea Index (DI): a severity index for upper airway-related dyspnoea - PubMed (nih.gov)
Nijmegen Questionnaire [60]	The Nijmegen Questionnaire and dysfunctional breathing - PubMed (nih.gov)
Hospital Anxiety and Depression Scale (HADS) [53]	The Hospital Anxiety And Depression Scale - PubMed (nih.gov)
Asthma	
Asthma Control Questionnaire (ACQ) [59]	Development and validation of a questionnaire to measure asthma control - PubMed (nih.gov)
Dysphonia	
Voice Handicap Index (VHI) [62]	The Voice Handicap Index (VHI): Development and Validation: American Journal of Speech-Language Pathology: Vol 6, No 3 (asha.org)
Voice Handicap Index-10 (VHI-10) [63]	Development and Validation of the Voice Handicap Index-10 - Rosen - 2004 - The Laryngoscope - Wiley Online Library
Voice Symptom Scale (VoiSS) [56]	VoiSS: a patient-derived Voice Symptom Scale - PubMed
Voice Related Quality of Life (v-RQOL) [57]	Validation of an instrument to measure voice-related quality of life (V-RQOL) - PubMed

Case history

1. **Voice and vocal hygiene behaviours:** Comment on hydration, caffeine and alcohol intake, smoking status/history, fume exposure, breathing route, vocal behaviours that are high impact and can cause damage to the vocal folds (including cough/throat clearing), use of cough lollies and voice use/demands.
2. **Medical history:** Particularly presence of respiratory conditions, gastro-oesophageal reflux disease, allergic rhinitis, postnasal drip, obstructive sleep apnoea, snoring, anxiety and depression. Consider pulmonary function testing and the clinical implications of the results. Make note of the patient's medication/dose and whether they are taking them as prescribed and use of angiotensin converting enzyme inhibitors medication.
3. **Previous behavioural treatments:** Some previously taught breathing programs may conflict with the goals of speech pathology intervention. It is important to note any previously taught breathing techniques taught in other fields such as physiotherapy, singing, yoga etc.
4. **Symptoms:** Identify patient symptoms and if there is more than one, determine which concerns the patient the most. Discuss the onset, duration and progression of symptoms and any observed patterns, which will help in identifying triggers. Ask the patient to identify sensations in the larynx that are present before symptoms occur, as this will help them to tune in to their body and have control over it. Explore strategies that the patient has already tried or finds helpful. You may also find it useful for treatment planning to discuss the impact of the symptoms on the patient's daily life.

More information

ACE inhibitors are used for hypertension, heart failure and myocardial infarction and many other diseases. Dry cough is the most common side effect of ACE inhibiting medications [1]. Exacerbation of asthma and bronchial reactivity has also been reported. Patients report dry cough with scratching feeling in the throat [2]

Asthma history

There are specific features of asthma history that need to be determined:

1. How and when was asthma diagnosed? If referred to speech pathology by a respiratory physician, the asthma diagnosis has usually been confirmed by diagnostic testing. In other cases, the diagnosis may be less certain.
2. Dose of asthma medications and devices used. Be aware that people can access Ventolin (salbutamol) over the counter at a Pharmacy without a prescription, therefore they may be taking Ventolin without a diagnosis of asthma from a respiratory physician. The Severe Asthma Toolkit (www.toolkit.severeasthma.org.au) has helpful explanations and resources regarding asthma medications [45].
3. Asthma control, including exacerbations and effectiveness of asthma medications in controlling symptoms. It is common for patients to report that their symptoms do not respond to asthma medication, which might suggest co-occurring ILO. It is also important to know how many puffs of asthma reliever are needed, how often they are required and if the patient regularly requires more than their recommended dose.
4. Asthma severity. Asthma is typically defined as mild/moderate or severe. The American Thoracic Society defines severe asthma as "*asthma which requires treatment with high dose inhaled corticosteroids plus a second controller and/or systemic corticosteroid to prevent it from becoming uncontrolled or which remains uncontrolled despite this therapy*" [64].
5. Consider when their asthma inhaler technique was last assessed. Worsening symptoms are often attributed to incorrect use of inhalers and because they are thought to be easy to use, often patients are not provided with adequate training. Approximately 68% of patients do not use their inhalers correctly with approximately 67% of medical staff unable to demonstrate or explain the salient steps of inhaler use [65]. There are excellent 'how to' videos on the National Asthma Council website (How-to videos - National Asthma Council Australia) that demonstrate how to use a variety of asthma puffers, nasal sprays, spacers and other devices. It can be very beneficial to watch these with a patient to confirm their technique is accurate.

Clinical assessment

Oral-musculature/cranial nerve examination

Including dryness in the oral cavity and oral candida.

Posture and tension

Including neck and shoulder tension (during quiet respiration and during phonation) and excess extrinsic laryngeal muscle tension (e.g. thyrohyoid, suprahyoid and mandible). It is important to feel the patient's neck, throat and shoulders to assess tension. Observe general body tension and how they are sitting in the clinic or holding themselves. For example, if they are bracing against the chair or leaning forward slightly.

Breathing

Observe tidal breathing and breathing during conversation. Make note of breathing route (oral/nasal/both), increased inspiratory or expiratory flow, breathing pattern (clavicular/thoracic/diaphragmatic/abdominal), breathing rhythm, signs of air hunger, and resting respiratory rate. Clinician's may report their clinical observations or use a slightly more structured assessment such as the Brompton Breathing Pattern Assessment (BPAT) [68] which is a simple observational assessment tool with 7 areas for the clinician to observe and report on. Also observe the coordination of respiration and phonation and make note of the presence of audible inspiration during connected speech.

Stand behind the patient and place your hands on the sides of their ribs. Feel the expansion of their rib cage (or lack thereof) during tidal breathing, deep breathing and during speech [69]. This is known as the Manual Assessment of Respiratory Motion (MARM).

Observe the patient sitting or standing. Ask the patient to place one hand on their chest and the other on their abdomen. Observe the movement and note whether there is any asynchrony between chest and abdominal movement. This is known as the Hi-Lo Breathing Assessment

Observe changes in respiration when performing voice assessment tasks and when walking (e.g. from waiting room to clinical room).

If breathing difficulties are observed, take note of the following:

a. Cycle of the breathing difficulty (inspiration/expiration/both),
b. timing of the breathing difficulty (at rest/physical activity/other)
c. presence of struggling for air (yes/no)
d. stridor (yes/no),
e. effortful inhalation (yes/no),
f. breath holding (yes and if yes note activity, or no)
g. additional abnormal respiratory patterns

If the patient reporting breathlessness despite seemingly being successfully treated for underlying organic diseases such as asthma, consider dysfunctional breathing.

Cough

Make note of the following:

1. Is cough observed during appointment?
2. If so, is it dry or moist and is it continuous or intermittent?
3. Is throat clearing present?
4. Is cough triggered by voice assessment tasks
5. Does the patient make any attempts to suppress cough and if so, how effective are these attempts.
6. Are there any other observations to make about cough?

Observe cough and throat clearing behaviours during voice assessment tasks, when talking/laughing, when walking and in response to odours if exposed (e.g. perfumes, surfaces cleaned with cleaning products).

Laryngoscopy when available can be a very helpful tool and is the gold standard for diagnosis of ILO. Abnormal vocal fold movement may be observed in some individuals during tidal breathing and following provocation tasks. Provocation tasks can include odour challenge, physical exercise and phonation challenge [66] [67]. Vocal fold movement should also be assessed during phonation tasks such as sustained phonation, connected speech, and pitch and loudness range tasks.

Spirometry if not already completed can be completed in office with a handheld spirometer. Training regarding performing the test and interpretation of the results is necessary.

Voice assessment including auditory-perceptual evaluation, maximum phonation time, pitch and loudness range tasks, fatigue test, and when required, acoustic voice analysis.

Swallowing

A clinical swallowing assessment is conducted if symptoms of dysphagia are reported by the patient. The Timed Swallow Test [70] can provide a quantified measure of swallow efficiency. A Fibreoptic Endoscopic Swallow Study (FEES) or Videofluroscopic Swallow Study (VFSS) may be recommended if the clinical swallowing assessment is abnormal.

Suitability and stimulability for therapy

Therapy techniques should be trialled during the assessment session to determine stimulability and symptom response to therapy exercises. The patient's suitability for therapy should also be discussed with them, including their motivation and goals, understanding of concepts explained and whether therapy is indicated based on assessment findings.

Interpretation of speech pathology assessment results

After completing the assessment, the speech pathologist will need to interpret the results and consider whether the patient's reported symptoms are consistent with the working diagnosis. The most common differential diagnoses are (1) Asthma, (2) ILO, (3) Dysfunctional Breathing (4) Muscle Tension Dysphonia, (5) Cough and (6) Exercise Induced Laryngeal Obstruction.

Patients might have these conditions in isolation or in combination or alternatively present with another condition. When interpreting the results, it might be helpful to consider what is the patients most severe symptoms, what symptoms does the patient say is the most important to them to address, what is causing or triggering the symptom and is there any relationship between cough, breathing and voice.

CHAPTER 8

SPEECH PATHOLOGY TREATMENT

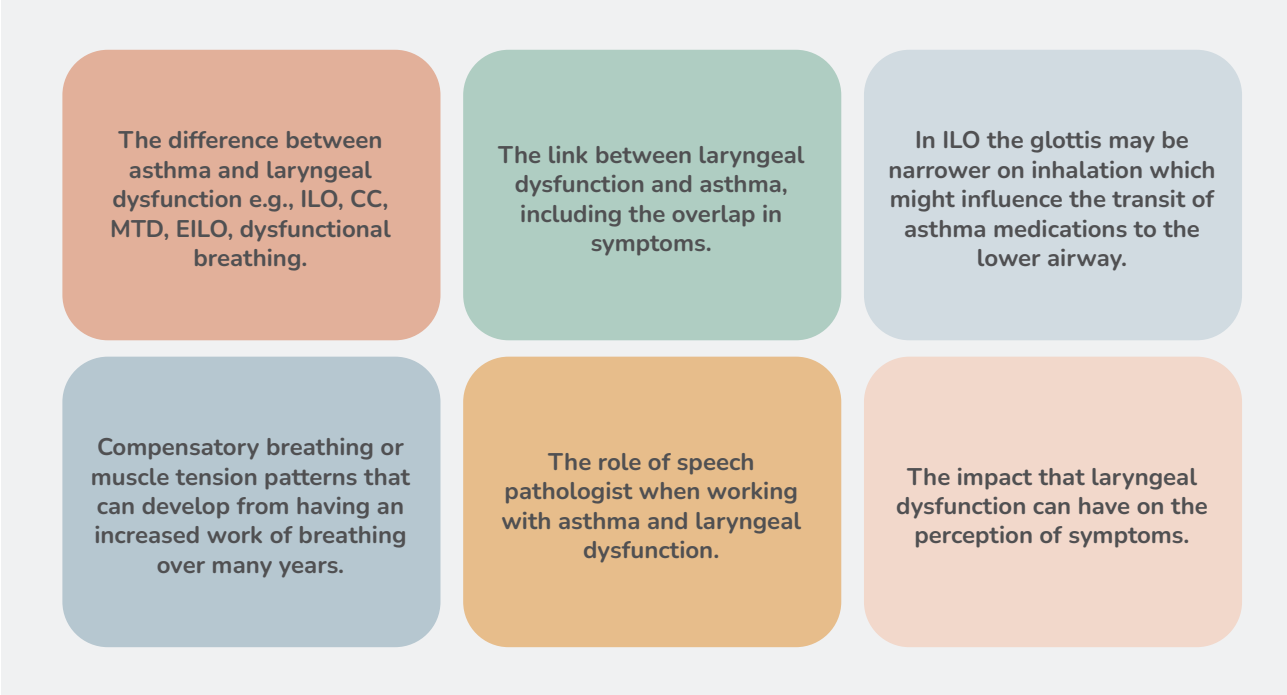
Speech pathology intervention is effective for laryngeal disorders co-occurring with asthma. There is little evidence regarding therapy dosage, however between 2 and 6 sessions are commonly provided. Treatment is often delivered face to face however some components of the treatment program can be done via telehealth, particularly the education and problem-solving components of the treatment.

There are four components to the speech pathology intervention [71]:

1. Education
2. Reduction of laryngeal irritation
3. Symptom control exercises
4. Psychoeducational counselling

Education

Education will need to be tailored for each patient, but some common points have been included below:



If cough is a key symptom, explain the protective mechanism for cough and the hyper responsive aspect to cough including the cyclic nature of cough and perpetuation of laryngeal irritation. This strategy aims to prime the patient for cough suppression therapy, if required.

If the patient has had a laryngoscopy, it can be beneficial to show the video to the patient. Laryngoscopy can also be used for biofeedback e.g. if patients can simulate the laryngeal sensation they experience just before and during an episode of ILO, have them do this on laryngoscopy and watch how the vocal folds behave. Alternatively, diagrams and online videos of laryngoscopy in patients with and without ILO or MTD can be shown.

Practice tip!

Patients are often overwhelmed by information during their session. Provide handouts that support your education so the patient can take home information and read in their own time.

Optimise hydration

Education will need to be tailored for each patient, but some common points have been included below:

Extra humidification by way of steaming can also be used to increase hydration to the vocal folds.

Develop specific methods/strategies to increase hydration that will fit into the patient's daily routine such as always keeping water with them.

Mouth breathing should be avoided where possible as it is drying to the laryngeal mucosa.

Empower the patient to recommend their own strategies that will be achievable in their day-to-day life.

Provide education regarding optimising hydration.

Recommend the patient sip water frequently, e.g. every 15 minutes.

Discuss the impact of dehydration on the vocal folds and how dehydration can exacerbate symptoms.

Recommend the patient drink sufficient water over the course of the day.

Reduce laryngeal irritants

Avoid excessive caffeine

Avoid excessive alcohol

Treat reflux with lifestyle strategies such as avoiding eating and drinking late at night/close to going to bed, consider the Acid Reflux Diet (Dr Craig Zalvan) and chew sugar-free chewing gum to neutralise acid levels in the throat, encourage saliva production to reduce dryness in the throat and keep swallowing rather than coughing or clearing the throat. Encourage patients to take reflux medications as prescribed and/or to take liquid Gaviscon after their largest meal of the day as well as before bed.

Avoid medicated lozenges that contain menthol, eucalyptus or other drying agents. Replace with non-medicated lollies to suck on which will address dryness in the mouth or throat and encourage regular swallowing

Discuss current smoking/vaping behaviours and address if necessary

Discuss treatment for postnasal drip/ sinus issues. Encourage the patient to take nasal sprays as prescribed or seek referral to ENT if they need a review

Discuss sleep and address issues such as sleep apnoea and snoring

Address triggers

Provide education regarding how to safely reduce vocal load (if possible and relevant)

Identify and reduce high impact vocal behaviours such as shouting/yelling, excessive talking, talking over background noise with poor technique, excessive throat clearing and/or coughing, forceful whispering, straining when talking

Symptom control exercises

The following summary outlines some specific techniques that could be used to target the 4 primary symptom areas: breathing, cough, voice and laryngeal sensation. This is not an exhaustive list, and you might need to trial a number of techniques to find one that works best for your patient.

Breathing

The aim of breathing exercises is to establish an efficient breathing pattern and reduce any laryngeal obstruction occurring during the breathing cycle.

Specific breathing techniques/exercises that could be used for ILO [71]:

- Establish relaxed abdominal tidal breathing
- Paradoxical Vocal Fold Movement (PVFM) release breathing
- Relaxed throat breathing
- Accent Method Breathing
- Reverse candle blow

Practice tip!

Acknowledge and reflect on the difficulties they have faced often leads to better "buy in" from patients who have had a long history of asthma.

Cough

Patients will often attribute their cough to their asthma diagnosis, however chronic cough due to laryngeal hypersensitivity can be independent of their asthma but co-occur with it. Patients need support and encouragement to understand that, even if they have asthma, they can learn to develop control over their cough.

Specific cough/throat clearing suppression therapy techniques that could be used [71]:

- Behavioural management for throat clearing
- Cough control breathing
- Cough suppression swallow
- Controlled exposure to triggers

Voice

There are several voice therapy techniques that could be used in individuals with asthma. The choice of technique is complex, and it is unclear whether any one technique is better than any other and there are no known voice therapy techniques that are contraindicated in those with asthma. It is beyond the scope of this document to explain all these techniques in detail.

Examples of techniques [71]:

- Conversational therapy training
- Accent method breathing
- Resonant voice therapy
- Casper Stone flow phonation (or stretch and flow phonation)
- Semi-occluded vocal tract exercises
- Stretches

Practice tip!

Look closely for compensatory muscle tension patterns in neck, jaw and even the lips!

Laryngeal sensation

Laryngeal hypersensitivity is common in severe asthma [72], however symptoms are often misattributed to co-occurring medical conditions.

Specific therapy techniques/exercises that could be used [71]:

Note that some of the points below are also included in the above sections.

- Cough suppression in order to relieve an abnormal sensation in the throat (see above section on cough)
- Swallowing exercises, such as safe swallow strategies, effortful swallow and saliva management strategies, can be helpful even though patients with globus pharyngeus generally have a normal swallow
- Stretches for the head and neck
- Relaxed throat breathing (see above section on breathing)
- General relaxation and stress management techniques
- Controlled exposure to triggers
- Simple strategies to avoid cough/throat clearing if these behaviours are occurring in response to globus
- Lifestyle strategies for reflux
- Hydration
- Minimize laryngeal irritation

Practice tip!

Mucus can be a recurring issue when working with patients with asthma and laryngeal dysfunction. Revisit the patients urge to cough vs need to cough. Remember, *the urge to cough is real, the need is not.*

Therapy planning

Therapy goals must be meaningful for the patient and clinically relevant based on assessment results. Therapy goals may change over the course of the treatment program. These goals should be revised with the patient during therapy sessions to promote consistent patient motivation and adherence. Treatment strategies should be tailored to the individual. Treatment strategies according to specific assessment findings have been summarised in table 7. This table matches possible assessment findings with possible treatment strategies; however, it is by no means an exhaustive list and should be used as a guide for decision making.

Psychoeducational Counselling

The effectiveness of speech pathology intervention depends on the patient's adherence to the treatment [71]. The patient's acceptance of the information and their adherence to treatment can be influenced by the way the education is provided. Some of the recommendations given to patients during treatment may appear to contradict the patient's beliefs or advice they have received from other health professionals. Patients may need to relinquish previously held beliefs about their symptoms and the strategies they have previously employed. The concepts of motivational interviewing are useful in the treatment of laryngeal dysfunction in asthma.

Patients may require assistance to develop realistic expectations about their progress in therapy. They will need to appreciate that therapy is hard work, and that intensive practice is needed to achieve therapy goals. A realistic goal for some patients is to gain control over rather than eliminate symptoms altogether and it may take several weeks or months to develop this control.

Some patients may report that emotional stressors can be a trigger for their symptoms. These patients may require extra support, and, in more serious cases, patients may require a referral to a mental health professional.

Therapy priming questions can clarify the impact of symptoms on the patient's quality of life. These questions also provide the treating speech pathologist with information about the patient's readiness to actively engage in the therapy program. Examples of therapy priming questions include:

What do you hope to achieve by participating in the speech pathology intervention?

What would you hope for in a treatment program to help you manage laryngeal dysfunction?

Patients may have received previous advice regarding breathing exercises, for example, from physiotherapy, singing tuition, pulmonary rehabilitation, yoga, or speech pathology. Some of these breathing patterns may not be consistent with the goals of the speech pathology intervention. It might be helpful to highlight the differences between the current therapy and previous techniques.

Table 7: Tailoring treatment strategies to assessment findings

Identified issue/s	Considerations	Potential objectives	Potential strategies
Triggers	• The overlap of triggers for asthma and laryngeal dysfunction	• Identify triggers • Implement strategies that address specific triggers • Deliberately expose the patient to triggers while implementing control strategies, once the patient is confident in their use	Potential strategies • Ask the patient to keep a written record of events to help identify specific triggers • Implement strategies to address specific triggers: *Talking:* May benefit from voice therapy to reduce laryngeal irritation *Eating / drinking without oropharyngeal dysphagia:* Consider strategies to manage laryngeal hypersensitivity *Stress/anxiety:* May benefit from relaxation exercises; May require mental health referral *Exercise:* May benefit from changing breathing technique during physical exercise *Fumes/odours:* Introduce avoidance and suppression techniques
Patient motivation	• The patient may have a long history of medical involvement, including dismissal or misattribution of symptoms • The patient may be unsure of what the goal of speech pathology is	• Patient and speech pathologist to agree upon goals that motivating for the patient • Empower the patient to feel motivated to actively participate in the management of their asthma and/or laryngeal hypersensitivity	• Ensure goals are aligned between speech pathologist and patient • Discuss barriers to change or engagement in speech pathology. Encourage the patient to be open and honest regarding their motivations for attending and what they hope to achieve and be mindful not to respond to these with any judgement • Give patient exit strategy as an option • Reinforce their current motivation regularly • Discuss their changing outcome measure scores to demonstrate changes and/or improvements
Deliberate coughing	• Patients often report that they "need" to cough however it is more likely that their larynx is hyper-sensitive. Sometimes patients need lots of support and repetition to understand this concept	• Educate patient regarding laryngeal hypersensitivity and lack of physiological benefit from cough • Reduce unnecessary coughing and throat clearing	• Respond to the urge to cough by sipping water and swallowing and/or swallowing saliva • Suck non medicated lollies • Avoid laryngeal irritants and identified triggers such as throat clearing, fumes, voice use etc. • Encourage patient to attempt to suppress their cough during the session with sips of water or swallows of saliva. Provide a cup of water if necessary and prompt them to sip if they forget. If they cough, prompt them to take a sip straight away and be aware for the next time. Also, might be beneficial to ask them to rate their urge to cough so their awareness increases. This is a helpful step as many patients do not realise how much they cough/throat clear so benefit from it being pointed out

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Identified issue/s	Considerations	Potential objectives	Potential strategies
Pattern of coughing	• Consider laryngeal hypersensitivity	• Identify pattern to cough (if there is one) • Identify triggers • Introduce strategies to address cough	*If intermittent:* • Increase awareness of throat irritation and implement strategies to suppress the cough at the first sign of irritation *If continuous:* • Aim for a set symptom free period during the day and gradually extend duration • Set aside designated time to focus on suppressing cough *If triggered by voice assessment* • Further investigation of voice and phonatory function • Observe for features such as hard glottal attacks and laryngeal focus of resonance that may be present • Voice therapy techniques *If triggered after eating* • Reflux strategies • Chewing gum after meals
Urge to cough	• Many patients have never thought about this before and may find it difficult to label their urge to cough appropriately	• The patient will identify their urge to cough early enough to utilise a chosen strategies to suppress cough or throat clear	• If patient is able to identify urge: Employ cough suppression technique (specify) at first signs of throat irritation • If patient is unable to identify urge: Rate urge to cough every 15 minutes and implement cough suppression strategy each time it rises over 2-3 • Use cough suppression technique to interrupt rather than prevent cough even if a sensation of something that needs to be cleared
Nocturnal cough and breathlessness	• Consider possible co-morbidities such as reflux or sleep apnoea	• Reduce/eliminate nocturnal symptoms of cough and dyspnoea • The patient will not be roused by symptoms during sleep	• Ensure optimal asthma management • Consider reflux treatment strategies such as o more inclined/upright posture in bed o waiting 2-3 hours after meals before lying down • Water beside bed for easy access as needed (although be mindful if the patient has reflux) • Encourage nose breathing • Encourage abdominal breathing while lying down for cough suppression
Severe ILO episodes	• The patient has likely attributed their symptoms to their asthma. This can be a difficult thought process to change	• Provide patient with short and long term strategies for ILO episode management	• Introduce emergency strategies for paradoxical vocal fold movement including how they incorporate their PVFM exercises into their asthma management plan

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Identified issue/s	Considerations	Potential objectives	Potential strategies
Difficulty breathing is the patients primary concern	• Consider how asthma and ILO and interact and overlap • What is the patients understanding of the mechanisms of their breathlessness? • Consider whether the patient may benefit from an asthma medication review or inhaler technique review	• Improve the patient's understanding of the mechanisms of breathlessness and the relationship between asthma and ILO • Identify causes of breathlessness • Implement strategies for management of breathlessness	• Ensure optimal medical management including compliance with any asthma medications • Assess for ILO if it hasn't already been done • Create plan for addressing breathlessness – e.g. using breathing exercises and not just reaching for puffers • Employ paradoxical vocal fold movement suppression techniques (e.g. PVFM release breathing exercise) at first sign of breathing difficulty or tightness • Encourage use of rescue strategy of sniff and blow out through pursed lips if their dyspnoea causes anxiety • Use PVFM breathing exercise just prior to inhaled asthma medications
Stridor	• Consider whether the patient is able to change their breathing pattern with instruction	• Eliminate stridor	• Assess for ILO if this has not been done already • Consider strategies to open the larynx more while breathing (such as sniff)
Habitual suboptimal breathing pattern	• The patient may have been breathing with a substandard breathing pattern for quite a long time	• Teach the patient a more efficient breathing pattern	• Identify atypical breathing pattern features such as clavicular breathing, mouth breathing, breath holding, abnormal breathing rate etc. • Increase the patient's awareness of their breathing pattern • Introduce abdominal breathing • Implement tactile cues to reduce shoulder and neck tension, if present • Encourage nasal breathing • Consider previously learnt breathing techniques that contradict with best practice for PVFM (such as those learned in yoga or pulmonary rehab)
Breath holding	• Consider the likelihood that this breathing pattern is habitual and long term and may be difficult to change. • Is the patient aware of their breath holding?	• Eliminate breath holding	• Draw attention to breath holding at rest and during other activities • Identify specific triggers or events related to breath holding so the patient's awareness will increase and they can address it • If laryngeal hyperfunction is also an issue, trial therapy such as stretch and flow phonation.

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Identified issue/s	Considerations	Potential objectives	Potential strategies
Oral breathing	• Consider that the patient may not be aware of their breathing pattern or the importance of nasal breathing	• Encourage nasal breathing	• Nasal wash (nasal douching) may be helpful to reduce or eliminate congestion • Review of nasal spray use if appropriate • Encourage the patient to speak with the GP who may refer to ENT for further assessment
Poor hydration	• Consider the patients daily activities and incorporate recommendations that the patient feels are achievable	• Increase hydration • Improve vocal hygiene by identifying/ reducing/ eliminating negative factors	• Optimise water intake • Encourage regular sipping of water • Try flavoured water options if patient dislikes water • Avoid excessive caffeine • Avoid excessive alcohol • Consider medication effects
Reflux symptoms or increased RSI score	• Encourage the patient to speak with their GP re-garding a review of their reflux treatment includ-ing assessment by Gastroenterol-ogist if indicated	• Introduce strategies to address symptoms of reflux • Facilitate further assessment by GP or Gastroenterologist if indicated	• Sleep with head elevated • Sleep on left side • Small frequent meals • Reduce tight clothing • Avoid eating for 2-3 hours before bed • Diet modification • Chewing gum • Address risk factors, such as smoking • Recommend using Gaviscon to improve symptoms
Possible anxiety or depression or raised HADS score	• Encourage the patient to talk with their GP regarding referral to a mental health professional	• Identify any triggers or “stressors” that could be addressed or avoided	• May benefit from relaxed breathing techniques, such as abdominal breathing • Encourage stress and anxiety management in whatever form that may take • Education regarding the impact of anxiety, depression and stress upon the physiological responses of the upper airway
Muscle Tension (jaw/ neck/larynx/ shoulders)	• Tension may be related to stress or anxiety or maladaptive postures or patterns used for many years	• Introduce stretches to address excessive tension	• Raise patient’s awareness of tension • Invite patient to ‘notice’ any tension while breathing. May ask the patient to ‘scan’ their body, taking notice of any particular areas of tension and releasing. May need repeated advice. • Head neck stretches (e.g. LMRVT) • Observe when the tension occurs and incorporate strategies to address this • Encourage improved posture and core strength

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Identified issue/s	Considerations	Potential objectives	Potential strategies
Difficulty understanding concepts and strategies	• Consider the best way to present your information to your patient clearly and concisely • Implement strategies for confirming the patients understanding or giving them a comfortable space to ask any questions	• Provide a comfortable space for your patient to ask questions without judgement • Improve patient understanding and empower them to take an active role in the management of their asthma and/or comorbidities	• Provide education on topics required and if out of speech pathology scope, support referrals to those who can provide the appropriate education (such as respiratory nurse) • Explain the aims of speech pathology intervention and what the patient may achieve by attending • Provide handouts and other suitable educational literature to the patient, so they can refer back to it as needed • Consider using video of strategies demonstrated in the clinic so the patient can re watch at home
Abnormalities in cranial nerve, dysphagia or oro-musculature assessment	• Consider the effects of impairments on the patient's overall presentation • Consider whether further assessment from other disciplines is indicated	• Tolerating a safe diet texture and fluid consistency • Further assessment of the patients swallow to determine optimal diet/fluid and management plan	• Investigate and manage oropharyngeal dysphagia as required
Abnormalities identified during voice screening, including for example, perceptual findings and/or increased VHI score	• What are the patient's current goals? Are they motivated to work on their voice? • Consider QOL impact of dysphonia and patient centred goals	• Improve vocal quality in alignment with patient goals • Eliminate dysphonia	• Thorough voice assessment • Voice therapy as indicated

HELPFUL RESOURCES

- **Global Initiative for Asthma**
  www.ginasthma.org

- **Asthma Toolkit**
  www.asthma.org.au/toolkit

- **Asthma Australia**
  www.asthma.org.au

- **Helpful Asthma Australia YouTube video on Asthma and phenotypes by Asthma Australia:**
  https://youtu.be/FQ-108CXXU8

- **Australia Government: Australian Institute of Health and Welfare**
  https://www.aihw.gov.au/reports/chronic-respiratory-conditions/chronic-respiratory-conditions/contents/asthma

- **Lung Foundation Australia**
  www.lungfoundation.com.au

- **National Asthma Council Australia – Excellent resources including how to videos for all types of puffers, spacers, nasal sprays and other medications.**
  www.nationalasthma.org.au

- **ILO/VCD Toolkit**
  www.ilovcdtoolkit.org

- **Severe Asthma Toolkit**
  www.toolkit.severeasthma.org.au

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