

# Inducible laryngeal obstruction

## A deceptive mimic of asthma, anaphylaxis and other airway disorders

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Inducible laryngeal obstruction, or vocal cord dysfunction, is a common but under-recognised cause of acute breathlessness that is often mistaken for asthma or anaphylaxis. Early recognition, accurate diagnosis and multidisciplinary management are essential to prevent harm and improve outcomes for patients.

Inducible laryngeal obstruction, also known as vocal cord dysfunction (ILO/VCD), is a common condition where the larynx narrows inappropriately, causing breathlessness.<sup>1</sup> It affects people of all ages and sexes, although about two thirds of patients are female. ILO/VCD is a great mimic of other airway disorders but can be diagnosed with careful history, examination and timely investigation.

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### Key points

- **Inducible laryngeal obstruction, or vocal cord dysfunction (ILO/VCD), is a common but under-recognised cause of acute breathlessness that mimics asthma, anaphylaxis and other airway disorders. Misdiagnosis can result in iatrogenic harm and severe impairment of quality of life.**
- **Key clues to the diagnosis of ILO/VCD include inspiratory breathlessness, throat tightness, voice changes and poor response to asthma therapy.**
- **Diagnosis requires a compatible clinical history and confirmation of inappropriate, reversible laryngeal narrowing (usually by laryngoscopy).**
- **Initial management focuses on breathing techniques and speech pathology-led laryngeal retraining.**
- **To help healthcare providers better identify and manage this disorder, an NHMRC-funded ILO/VCD toolkit is now available at [www.ilovcdtoolkit.org](http://www.ilovcdtoolkit.org).**

The most important function of the larynx is to protect the lower airway against aspiration or inhalation of noxious agents, which is achieved by 'protective' laryngeal closure. This reflex can be inappropriately activated, resulting in ILO/VCD, with other laryngeal dysfunction, including altered voice and cough, often also being seen.<sup>2,3</sup>

When ILO/VCD is severe, people may receive well-intentioned but potentially harmful interventions. For example, they may be treated with intubation (for stridor), adrenaline (for presumed anaphylaxis) or oral corticosteroids (for presumed severe asthma).

A freely available, peer-reviewed, Australia-led toolkit ([www.ilovcdtoolkit.org](http://www.ilovcdtoolkit.org)), funded by the NHMRC, has recently been launched. This toolkit aims to equip healthcare providers with information to diagnose and manage this disorder.

### How does ILO/VCD present?

In some individuals, ILO/VCD may be chronically present, with episodic flares. More often, symptoms occur in acute attacks that come on rapidly (typically within seconds). These attacks may arise spontaneously or be associated with identifiable triggers. They can be severe enough for a patient to present to an emergency department; this can occur frequently for some patients.

### 1. Case study, part 1: presentation, history and examination

You are asked to urgently see Stacey, a 40-year-old woman with breathlessness that came on suddenly at work after exposure to a coworker's perfume and a recent viral upper respiratory tract illness. Stacey had childhood asthma which she 'grew out of'. In a prior episode of breathlessness, she tried salbutamol and had a 5-day course of prednisolone from a colleague, but 'they didn't work'. While waiting, she received 12 inhalations of salbutamol with a spacer but is still breathless on examination.

On your review, Stacey is receiving a further 12 inhalations of salbutamol with a spacer and is mildly tachypnoeic and tachycardic. You notice inspiratory stridor from across the room. Her voice is raspy. On auscultation, her chest is clear, but there are inspiratory noises that are loudest over the larynx. On further history, Stacey reports a dry cough, 'as though something is stuck in my throat, but I can't get it up'. Breathlessness comes on suddenly when she enters cold environments or is exposed to strong scents. Her voice changes when she is breathless.

Commonly reported triggers for ILO/VCD include:

- strong odours and scents (e.g. perfume, cleaning products, aerosols and chemical smells)
- environmental irritants (e.g. smoke, exhaust fumes and dust)
- strong emotions (e.g. stress or anxiety)
- physical exertion
- mechanical airway stimulation (e.g. talking or shouting)
- respiratory tract infections
- changes in temperature or cold air.<sup>4</sup>

These attacks can abate rapidly (within minutes), especially if the offending trigger or stimulus is removed. Despite resolution of acute symptoms, many patients report a sense of fatigue or exhaustion that can linger in the aftermath of an ILO/VCD attack and significantly affect their wellbeing.

Triggers for ILO/VCD are more often mechanical or irritants, contrasting with the environmental allergens generally associated with asthma (e.g. pollens, moulds, house dust mite and animal dander). Laryngeal hypersensitivity, such as a sensation in the throat or an irritated tickle before coughing, may also be present, as well as voice changes during symptomatic episodes.

Some people manifest prominent dysphonia (impaired voice quality), globus (sensation of lump or tightness in the throat), a sensation of choking, throat tightness or discomfort. Changes in voice, including hoarseness or intermittent loss of voice (aphonia), may be noted during episodes.

### History and examination

A thorough history is essential for diagnosis and can help differentiate ILO/VCD from other conditions, such as asthma and anaphylaxis. Patients should be asked about the timing, duration and onset of symptoms, as well as what triggers acute attacks.

Between episodes, physical examination is often normal. Voice

quality and habitual throat clearing during examination may offer diagnostic clues to underlying laryngeal dysfunction. It is useful to examine the patient for chronic nasal congestion and mouth breathing.

Examination during an acute attack may demonstrate audible stridor or upper airway noises, typically loudest over the throat, with an absence of expiratory lower airway wheeze (Box 1). Oxygen saturation is often normal. If a patient is intubated, pressures required for mechanical ventilation are much lower than would be expected for life-threatening asthma.

A key diagnostic clue is that asthma treatments do not improve the condition of a patient with ILO/VCD (Box 2). Other key clues include altered voice, the inability to speak when breathless and a sensation of tightness in the throat or neck.<sup>5</sup> Breathlessness is usually worse on inspiration than expiration (although this feature is not present in all patients). The breathlessness is often unexplained by or out of proportion for other respiratory conditions, such as asthma or chronic obstructive pulmonary disease (COPD). Cough is often present but is not specific for ILO/VCD.

### Phenotypes of ILO/VCD

ILO/VCD can be classified into four phenotypes: lung-associated, pseudo-allergic or incident-associated, exercise-induced and classic ILO/VCD (Figure 1).<sup>6</sup>

In the most common phenotype, lung-associated ILO/VCD, the cardinal symptom is breathlessness.<sup>6</sup> Patients usually describe dyspnoea, persistent cough, wheeze (which may be more accurately labelled stridor, as it is caused by laryngeal narrowing rather than lower airway bronchoconstriction) and occasionally chest tightness. These symptoms overlap with those of asthma, so patients may have been labelled as having difficult-to-treat, brittle or refractory asthma. An emphasis on treating the supposed asthma can lead to delays in diagnosis of ILO/VCD and inappropriate treatment, such as corticosteroids and bronchodilators.

Some patients manifest so-called pseudo-allergic or incident-associated ILO/VCD.<sup>7</sup> This is characterised by sudden onset of symptoms such as dyspnoea, a sensation of throat closure and stridor after exposure to substances perceived to be allergens, whether inhaled, ingested (e.g. food) or injected (e.g. a vaccine or antibiotic). These attacks are sometimes mistaken for acute allergic reactions or anaphylaxis.<sup>8,9</sup> Patients may have had multiple hospital or emergency department presentations where they were treated with adrenaline or intubation without evidence of a genuine allergic process. These patients are often referred to allergists and immunologists.

Exercise-induced laryngeal obstruction is a distinct clinical entity and typically presents in younger people who engage in high levels of exercise.<sup>10</sup> This often involves supraglottic obstruction with symptoms of acute breathlessness and throat tightness occurring at peak exercise.

Classic ILO/VCD was described in a sentinel publication in 1983 as the uncommon but striking scenario of individuals presenting

with asthma-like features in the context of prominent psychological and mental health disorders.<sup>11</sup>

## Diagnosis of ILO/VCD

ILO/VCD is challenging to diagnose because of its varied presentations that can be similar to those of many other respiratory and upper airway conditions, including asthma, COPD and anaphylaxis. A high index of suspicion is therefore needed. Australian data show that the mean delay to diagnosis is 5.5 years, reflecting opportunities for more rapid recognition.<sup>12</sup>

Depending on the predominant presenting symptoms and underlying ILO/VCD phenotype, patients can be seen by a range of practitioners, including primary care physicians, emergency physicians, respiratory physicians, allergists and immunologists, or ENT surgeons. In primary care, a typical patient progression might involve a patient diary to record trigger factors, consideration of treatments for rhinitis and reflux, and spirometry to assess airway diseases, before referral for laryngoscopy to achieve a definitive diagnosis.

Internationally accepted formal diagnostic criteria require a compatible clinical context (i.e. a clinical picture that is suspicious for ILO/VCD) and verification of inappropriate, transient and reversible laryngeal narrowing. The latter is usually achieved by specialists performing laryngoscopy with provocation.<sup>1</sup> Provocation can be done in many ways but typically involves exposure to a patient's known triggers (if feasible), odour, hyperventilation, phonation or mannitol. Demonstration of sustained laryngeal inspiratory narrowing of more than 50% (Figure 1) is diagnostic, although there is no consensus on a diagnostic threshold of duration.<sup>1</sup> Conversely, the presence of symptoms in the absence of laryngeal narrowing excludes the diagnosis.

For exercise-induced ILO/VCD, continuous laryngoscopy during exercise involves cardiopulmonary exercise testing with a laryngoscope in situ to achieve provocation by exercise. This test requires a highly specialised setup and is not available in most centres.

Laryngoscopy can be difficult for patients to access, especially in regional and remote areas. Initiatives are underway to increase the number of Australian respiratory and allergy physicians and speech pathologists who can perform outpatient laryngoscopy.

Because of limitations in scaling these diagnostics, other modalities have been examined. The inspiratory flow-volume loop can sometimes show inspiratory flattening, but this is not sensitive or specific.<sup>13</sup> Spirometry is important to assess for comorbid asthma or COPD. Dynamic (video) CT of the larynx has modest sensitivity (about 60%) but high specificity (greater than 90%) and could reduce the need for laryngoscopy.<sup>14</sup>

Differential diagnoses vary depending on the ILO/VCD phenotype but are mainly asthma, COPD and anaphylaxis. In patients who respond poorly to generally effective treatments for these conditions, ILO/VCD is an important diagnosis to consider and investigate. Careful history is key, and other conditions to consider are dysfunctional breathing and, rarely, subglottic or tracheal stenosis or other laryngeal diseases (including vocal fold paralysis, neurological diseases and cancer).

## 2. Diagnostic clues for ILO/VCD

### Clues it is the larynx

- Throat tightness during attacks
- Voice changes
- Symptoms confined to the throat and upper chest
- Breathlessness worse on breathing in
- Noisy breathing during attacks (typically stridor)
- Symptoms of laryngeal hypersensitivity (e.g. abnormal sensation in the throat including ache, itch, pain or foreign body sensation, or the inability to tolerate light pressure on the neck)

### Clues it is not asthma

- Rapid onset of attacks (seconds to minutes)
- Specific triggers for attacks
- Odours trigger attacks
- Inhaled bronchodilators are ineffective or have relatively little effect
- Little or no therapeutic response to high-dose inhaled corticosteroids or oral corticosteroids
- Low ventilation pressures if intubated, relative to the severity of the attack

### Clues it is ILO/VCD

- Inspiratory stridor and an absence of expiratory lower airway wheeze
- Flattening of the inspiratory flow-volume loop on pulmonary function testing, although this is neither sensitive nor specific

Abbreviation: ILO/VCD = inducible laryngeal obstruction or vocal cord dysfunction.

## Comorbidities

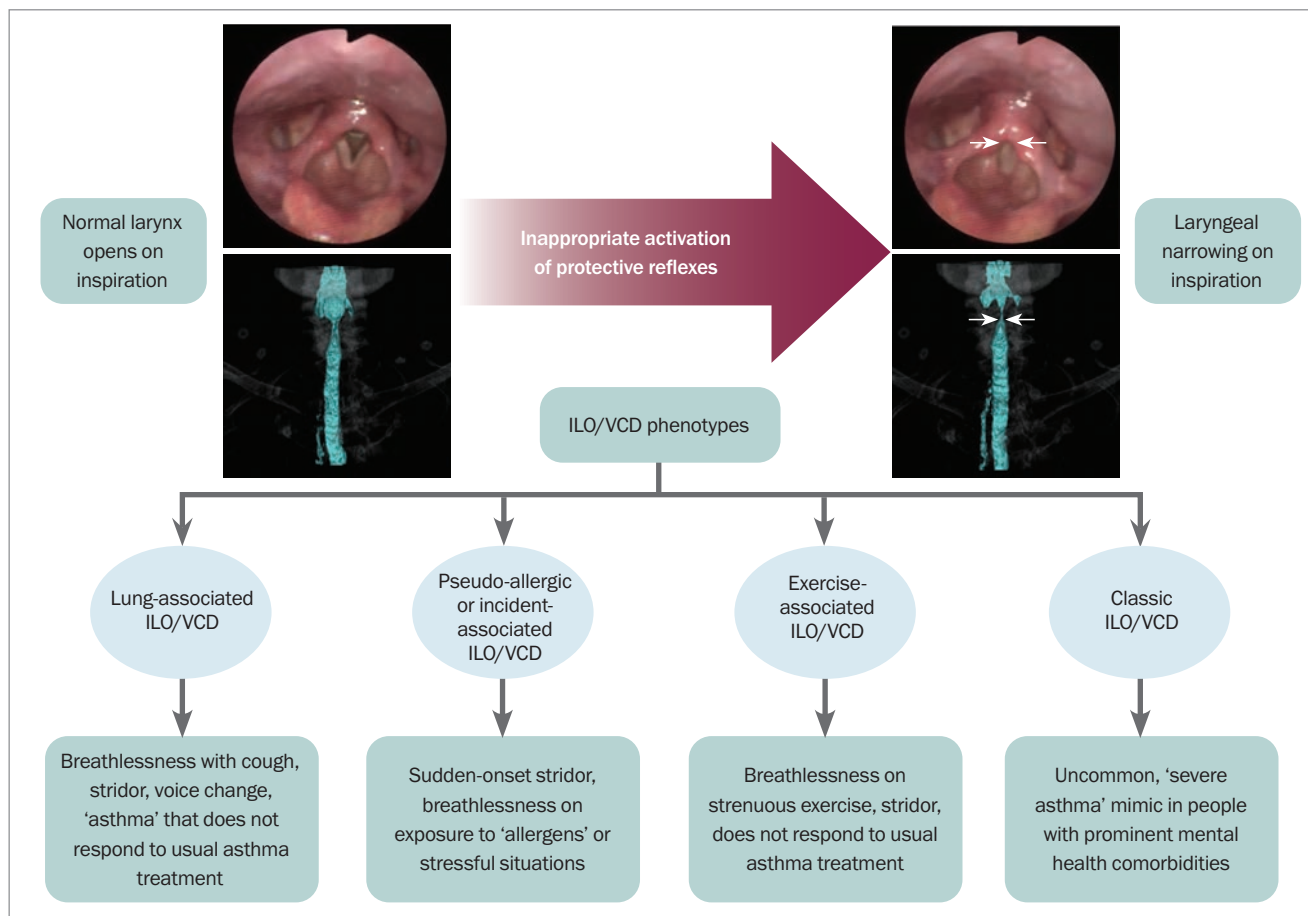
The disorder is often associated with a range of comorbidities, such as asthma, COPD, airway disease, obesity, anxiety, gastro-oesophageal reflux disease, chronic rhinosinusitis, allergic rhinitis (postnasal drip) and obstructive sleep apnoea. Studies have detected ILO/VCD in 30 to 40% of people with asthma or COPD.<sup>15</sup> These comorbidities should be identified and their management optimised because uncontrolled comorbidities can trigger ILO/VCD by inappropriately activating laryngeal defensive mechanisms.

Dysfunctional breathing (also known as breathing pattern disorder) is often associated with ILO/VCD.<sup>16</sup> Observation of breathing patterns at rest for breath holding, thoracoabdominal asynchrony (unco-ordinated movement of thorax and abdomen during breathing) and hyperventilation can be useful, as can observation of head and neck posture and accessory muscle tension.

## Management

### Diagnostic and management pathways

ILO/VCD is a complex disorder that benefits from multidisciplinary approaches to ensure robust diagnosis and effective management. This can involve nurses (Box 3), GPs and respiratory physicians (for diagnosis of the cause of breathlessness), ENT surgeons (for diagnosis and exclusion of other disorders) and speech pathologists (for diagnosis and treatment). If mental health conditions are considered to be contributory, psychiatrists and psychologists may also be involved.



**Figure 1. Clinical phenotypes of ILO/VCD.** The lung-associated phenotype occurs in up to 20% of people with mild asthma and up to 50% of people with severe asthma, making their asthma appear difficult-to-treat, brittle or refractory. Incident-associated ILO/VCD occurs in stressful situations, such as vaccination or during incidents where exposure to irritants may occur. Exercise-induced ILO/VCD typically occurs in adolescents or young adults who undertake vigorous physical exercise, where it can mimic exercise-induced asthma. Classic ILO/VCD is often seen in people with high psychological or mental health burdens who may suddenly develop ‘severe asthma’ or ‘stridor’.

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Multidisciplinary approaches have been shown to significantly reduce GP and hospital visits and oral corticosteroid prescriptions for incorrectly diagnosed asthma.<sup>17,18</sup> ILO/VCD multidisciplinary team (MDT) meetings now operate in various formats in most major cities in Australia. A typical intake pathway begins with GP referral to a respiratory specialist, who performs initial assessment to ensure other mimics and comorbidities are thoroughly understood, then refers the patient on to an MDT clinic or other locally available MDT model of care. The MDT clinic model is only available in a handful of centres, but initiatives are underway to try to increase the number of clinics nationally and internationally. Alternative delivery models, such as telemedicine-based MDTs, offer great potential and can make a geographically dispersed MDT model feasible while retaining strong interdisciplinary collaboration.

It is anticipated that MDT demand will continue to grow as recognition of ILO/VCD increases. It is feasible for respiratory physicians to diagnose ILO/VCD in outpatient clinics, thereby

enabling MDT clinics to only evaluate more complex cases, where diagnosis requires specialist assessment or continuous laryngoscopy during exercise testing.

A key priority remains GP recognition and referral, as most patients will initially present in a community health setting, have comorbidities benefiting from care co-ordination and ultimately require high-quality, holistic, comprehensive care.

**Speech pathology**

Speech pathology treatment is the current standard of care for ILO/VCD. Referral processes for speech pathology vary. In some regions, speech pathologists are involved in the diagnosis of ILO/VCD via laryngoscopy, either in speech pathology-led clinics or in joint clinics with a medical professional. In other regions, patients may be referred to a speech pathologist once the ILO/VCD diagnosis has been confirmed. As a minimum, patients should be evaluated by an otolaryngology or respiratory medicine specialist before speech pathology treatment to

### 3. Tips from nurses on managing ILO/VLD

- Provide reassurance during acute ILO/VCD episodes: stay calm and use gentle, slow breathing cues such as 'sniff in, blow out through pursed lips'.
- Take the time to listen and validate patient experience: confirm that symptoms occur involuntarily and reassure patients that, with understanding and breathing techniques, they can regain a sense of control.
- Clearly differentiate ILO/VCD from asthma: note difficulty with breathing in and poor response to bronchodilators, and document triggers.
- Encourage breathing retraining: reinforce techniques taught by speech pathology and refer early for ongoing support.
- Reduce trigger exposure: advise avoidance of smoke, perfumes, cold air or any known triggers and manage reflux symptoms.
- Address emotional wellbeing: validate patient's distress, normalise anxiety responses and suggest mindfulness or counselling if needed.
- Empower self-management: encourage use of symptom diaries and personalised rescue breathing plans.
- Facilitate continuity of care: ensure good communication between GP, respiratory physician and speech pathologist.

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ensure that medical and surgical conditions are thoroughly evaluated. In some circumstances, it may be possible for the medical evaluation and speech pathology evaluation to occur simultaneously.

Speech pathology treatment, also known as glottal retraining therapy, laryngeal recalibration therapy or upper airway control therapy, typically involves between two and six sessions with a speech pathologist (Box 4). Treatment encompasses exercises to promote abduction of the vocal folds during respiration. These exercises encompass a range of breathing, voice and laryngeal deconstriction techniques. Some specialised physiotherapists also offer this therapy.

The choice of exercises is not formally prescribed and needs to be tailored to the individual (Figure 2). A primary objective of these exercises is to open the larynx during inspiration. An example is sniffing, which contracts the posterior cricoarytenoid muscle and abducts the vocal folds. This is followed by expiration, which increases oral and pharyngeal pressure and maintains vocal fold abduction during exhalation by providing positive end-expiratory pressure. In addition to promoting vocal fold abduction during respiration, the therapy establishes more efficient breathing and phonation to reduce phonotrauma and laryngeal hypersensitivity.

Importantly, accurate and automatic recall of the exercises requires regular practice with multiple repetitions when asymptomatic, with careful attention to correct technique. Patients are taught to recognise the sensation that precipitates an episode of ILO/VCD and use the technique to prevent or interrupt the episode. They therefore require patients to be aware of the precipitating sensation, and this awareness can vary between patients. An example of rescue breathing strategies is shown in Figure 2.

### 4. Case study, part 2: management

After you recognise that Stacey likely has ILO/VCD, you coach her through rescue breathing exercises, and her breathlessness abates. You refer her to a respiratory medicine specialist to rule out active asthma. The diagnosis of ILO/VCD is confirmed with laryngoscopy on provocation (hyperventilation), where her larynx is shown to be narrowing during inspiration. She begins a three-visit course of speech pathology.

Stacey's ILO/VCD symptoms abate and resolve with speech pathology treatment. She has learned to recognise her symptoms and can self-manage with rescue exercises.

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In cases where the patient has been slow to employ the technique or the ILO/VCD episode has occurred without warning, the focus is on early interruption rather than avoiding the episode. Once the exercise can be performed correctly in the clinical setting, it should be incorporated into physical activity and during graded exposure to triggers.

Follow-up speech pathology appointments are essential to support home practice and facilitate use of the exercises to prevent ILO/VCD episodes. Outcomes are better for patients who complete their therapy sessions, and it is not feasible to judge the outcome after only one or two sessions.

Treatment relies on patient adherence, and patients need to understand their condition and the rationale for treatment for the therapy to be effective. Patients may require additional psychological support. ILO/VCD episodes can be alarming for patients and onlookers, and patients may be terrified of dying during an episode. Treatment can be incorporated into other multidisciplinary treatments for related conditions, such as asthma and anaphylaxis. It is pertinent to have a management plan to guide individuals regarding the timing and frequency of exercises, medications and when to seek medical care.

#### Medical treatment

When speech pathology fails, botulinum toxin injection to the vocal folds (usually unilateral) can provide relief for many patients.<sup>18</sup> This should only be done by experienced practitioners after comprehensive MDT review. In situations of severe acute breathlessness caused by ILO/VCD (e.g. in the emergency department), use of continuous positive airway pressure can be trialled. This is often effective at 10 to 15 cmH<sub>2</sub>O, but controlled studies are lacking. Use of neuromodulators (e.g. amitriptyline) and other pharmacotherapies is not supported by clinical studies.

Where other comorbidities are active, these are managed independently (e.g. an asthma exacerbation would be managed according to the *Australian Asthma Handbook* guidance on acute asthma, and the ILO/VCD would be separately managed).

#### Patient impact

ILO/VCD can markedly impair quality of life through both its physical and emotional effects. Qualitative research shows patients

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## FEATURE INDUCIBLE LARYNGEAL OBSTRUCTION CONTINUED

# RESCUE BREATHING

**WHAT ARE RESCUE BREATHING STRATEGIES?**

Rescue breathing strategies are designed to help alleviate vocal cord dysfunction (VCD)/inducible laryngeal obstruction (ILO) symptoms by opening the vocal folds.

They should be used at the first sign of irritation or a change in breathing.

*The goal is to ward off the episodes, recover breathing more quickly and easily, reduce the frequency of episodes, and eventually, keep them from happening at all.*

### EMERGENCY SNIFF

1. Sniff (inhale for 1-2 seconds)
2. Breathe out through pursed lips (for 2-4 seconds) like you're blowing up a balloon
3. Repeat 3 times
4. Sip water

### PURSED LIP BREATHING

1. Shoulders down (keep a relaxed posture)
2. Hand on abdomen
3. Gentle sip of air IN through relaxed lips for about 1 second
4. Gently blow air OUT through slightly pursed lips (for 2-3 seconds) like you're blowing up a balloon.
5. Repeat 5 times

### BEAR DOWN AND SWALLOW

1. Push your hands together
2. Tilt your head toward your chest
3. Effortful swallow: Dry swallow With water

Please note that the cough suppression swallow will only work if you remember to do it at the very first sign of irritation.

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Figure 2. Sample rescue breathing information sheet for patients with ILO/VCD. Without appropriate coaching, some patients learn suboptimal or ineffective techniques that can complicate subsequent therapy. Ideally, rescue breathing strategies should be individualised and the patient's technique checked by a speech pathologist.

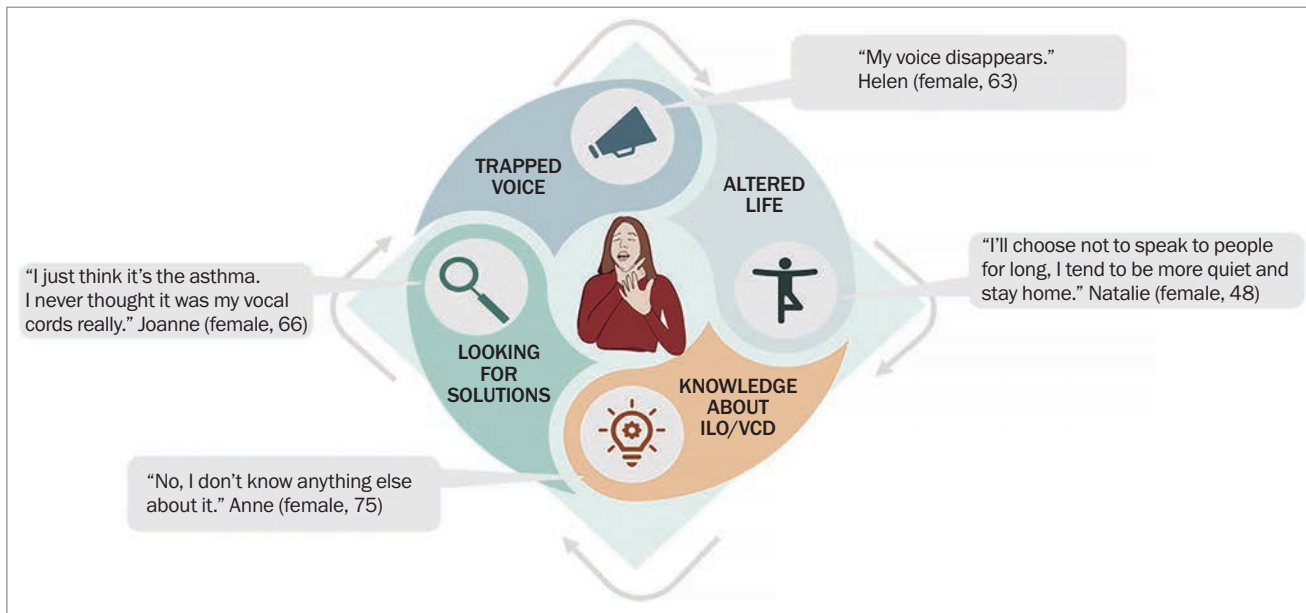
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report impact in four domains: looking for knowledge, looking for solutions, a 'trapped voice' and altered life (Figure 3).<sup>19</sup>

### Looking for knowledge and solutions

Delayed diagnosis is very common, and many patients are treated for asthma or anaphylaxis for years before receiving the correct diagnosis. Asthma and anaphylaxis are often communicated to the patient as being

life-threatening, so the experience of breathlessness, throat tightness, inspiratory stridor or hoarseness during an ILO/VCD episode can provoke significant fear. This anxiety is intensified when there is minimal or no response to asthma medications. Taking time to explain how ILO/VCD differs from asthma or anaphylaxis reassures patients, validates their experience and enhances their confidence in self-management.



**Figure 3. Impacts of ILO/VCD on patients' physical, social and emotional quality of life.**

Abbreviation: ILO/VCD = inducible laryngeal obstruction or vocal cord dysfunction.

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### Trapped voice and altered life

Many patients literally lose their voices or have difficulty communicating because of their altered and inconsistent voice quality. Patients often avoid exercise or outdoor physical activity for fear of triggering symptoms. Depending on individual triggers, some also avoid eating or drinking in public due to coughing fits, breathlessness or embarrassment. Participation in work, school, social activities and intimate partner relationships may be affected, further reducing quality of life.

### Emotional impact

The unpredictable and sudden nature of ILO/VCD episodes can significantly affect mental health and wellbeing. Patients often report anxiety, stress or depression arising from the uncertainty of when an episode will occur. Attacks typically develop abruptly, with sensations of suffocation, panic or loss of control. These experiences can erode patients' self-confidence and lead to social withdrawal if not addressed through accurate diagnosis, reassurance and patient education.

### Conclusion

ILO/VCD is a common and impactful disorder that can severely impair quality of life, result in iatrogenic complications from well-intentioned treatment directed at incorrect diagnoses, and consume considerable healthcare resources during lengthy periods of apparently unexplained symptoms.

Diagnosis can be challenging and, depending on their phenotype or presentation, patients may see a wide variety of healthcare providers. A key clue to the diagnosis of ILO/VCD is that patients do

not respond as expected to treatment given for other suspected conditions. Recognition that the clinical situation is atypical for the presumed condition combined with features of laryngeal involvement should arouse suspicion for ILO/VCD. Laryngoscopy with provocation remains the gold-standard diagnostic test, with laryngeal narrowing on inspiration when patients are symptomatic confirming the diagnosis. Gaining access to diagnostic laryngoscopy, MDT clinics and treatment can be difficult, particularly in regional and remote areas, and efforts are underway to expand their availability.

Most individuals respond well to speech pathology treatment, but the condition can relapse and re-treatment may be successful. A new, peer-reviewed Australian website ([www.ilovcdtoolkit.org](http://www.ilovcdtoolkit.org)), funded by the NHMRC, has been launched to help healthcare providers diagnose and manage this disorder. **RMT**

### References

A list of references is included in the online version of this article ([www.respiratorymedicinetoday.com.au](http://www.respiratorymedicinetoday.com.au)).

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