

Asthma and Vocal Cord Dysfunctions –relations and controversies

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Disclosure/Disclaimer

- Dr A.K.M.Nizam Uddin has no personal financial relationships with commercial interests.

An aerial photograph showing a large, multi-story, light-colored building complex, identified as Monash Hospital, situated in an urban area. The hospital is surrounded by residential neighborhoods with houses and streets. A large green field, likely a sports field, is visible to the left of the hospital. In the background, more urban development and a large body of water (Port Phillip) are visible under a clear sky. The text "Monash University" is overlaid in a black box at the top center.

Monash University

Monash Hospital











Outline of presentation

- Nomenclature
- Normal Vocal Cord movement
- Pathophysiology of VCD
- VCD and asthma
- Diagnosis of VCD
- Treatment of VCD

Definition of VCD

“The paradoxical adduction of the vocal cords during inspiration, which causes partial and sometimes severe airflow obstruction”

VCD

- First described by Christopher et al (NEJM 1983)
- Perfect mimic of asthma but patients did not have asthma
- Diagnosis: laryngoscopy
- Treatment: speech and psychotherapy

What's in a name?

- Term VCD first used by Christopher et al (NEJM 1983)
- Recently: ERS/ELS/ACCP 'consensus':
umbrella term = ILO + description
- For example, obstruction at the glottic level:
'exercise-induced ILO glottic, inspiratory, fast onset, fast resolution type'

What's in a name?

- This is simply not practical as a 'name'
- VCD is the name that has 'stuck' with clinicians and allied health professionals (and patients)
- Better: VCD as umbrella term – and Paradoxical Vocal Cord Movement (PVCM) as the quintessential abnormality?

Normal VC movements

- * Vocal cords stable and may open slightly during inspiration
- * Variably narrowing during expiration, $<40\%$ in health, may be worse (but possibly still normal) in OLDs
- * Paradoxical vocal cord movement (PVCM) during inspiration = typical abnormality in VCD (Christopher et al, 1983)

Pathophysiology of VCD

- Very little understood
- Pathophysiology postulated for VCD tends to highlight predisposing factors rather than specific mechanisms
- Recent research: attempts to achieve integration of various strands

Dysfunctional breathing

- Definition is not specific
- Measured using Nijmegen questionnaire
- Nijmegen questions rather non-specific, scores $>19/23$ indicate DB
- Nijmegen partly validated in asthma

Dysfunctional breathing

- May contribute to SOB in asthma
- Prevalence 30% asthma vs. 10% healthy (Thomas et al, 2001, 2005)
- Breathing retraining helped QOL but PF unchanged (Thomas et al 2003)
- Association with VCD not researched

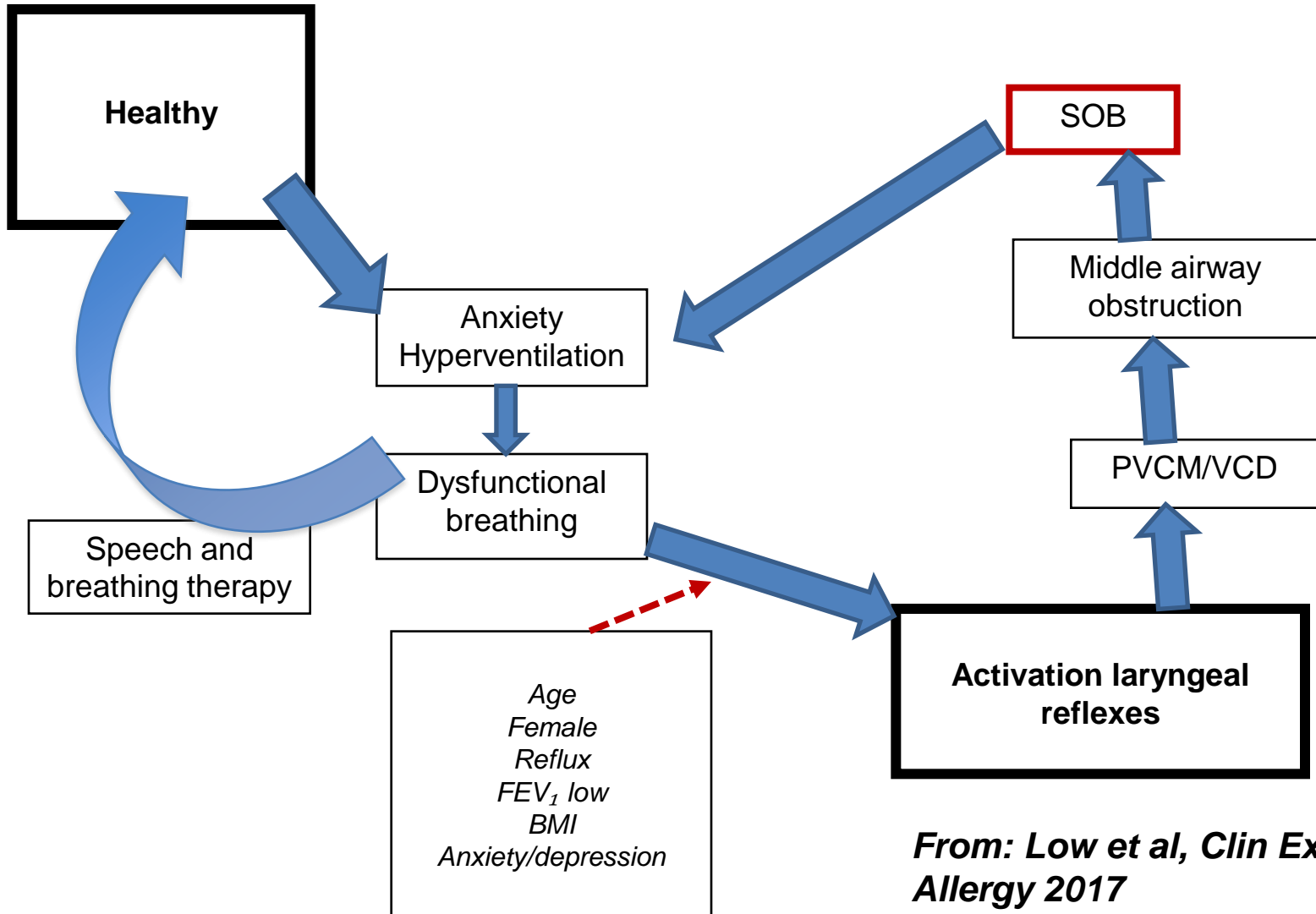
VCD is associated with Dysfunctional Breathing

Table 2. Association of patient and asthma disease features with PVCN

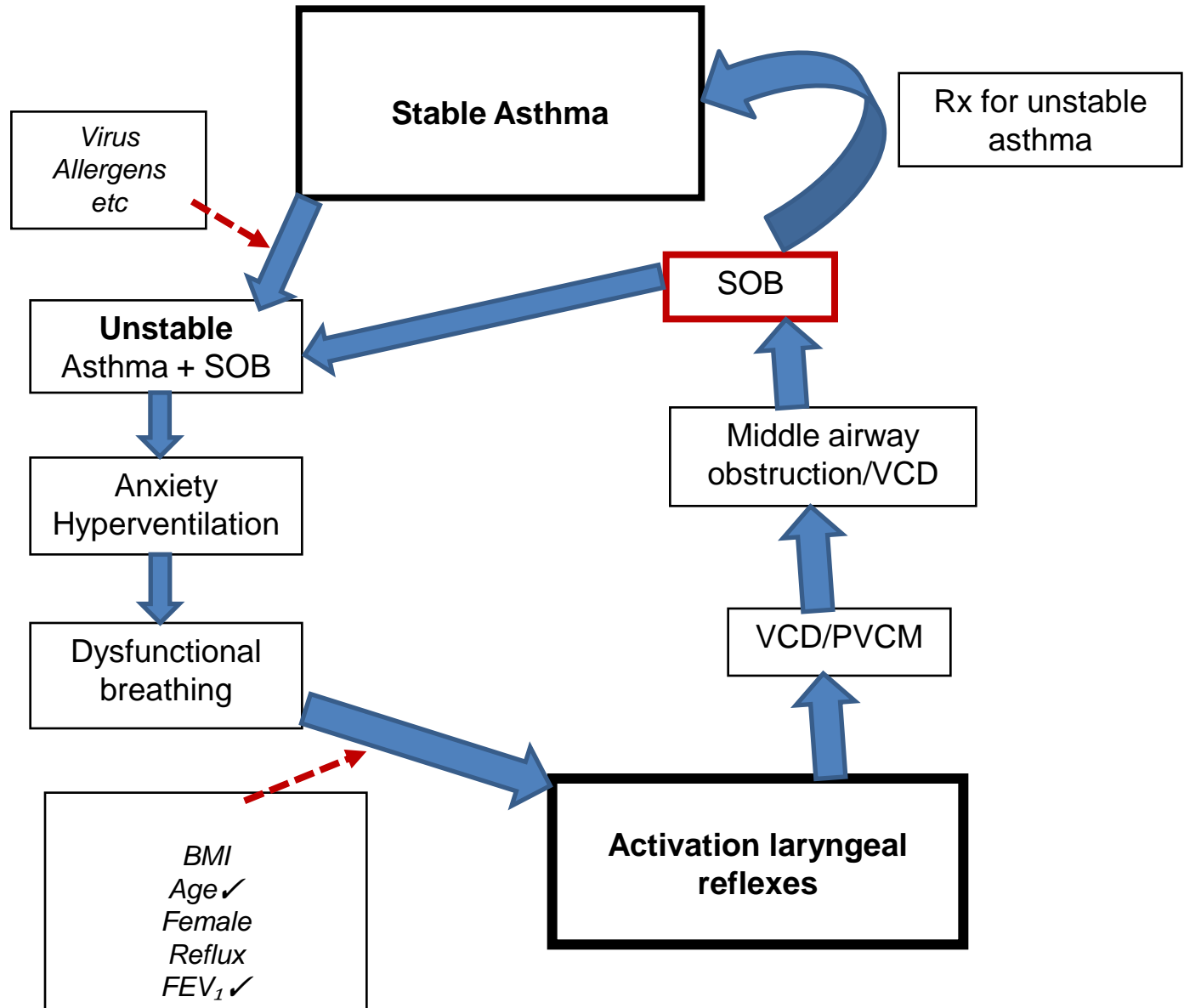
	PVCN not detected (n = 113)	PVCN detected (n = 42)	OR	P-value
Gender (Female)	84/113	29/42	0.77	0.54
BMI > 30 kg/m ²	50/113	20/42	1.14	0.72
FEV ₁ < 80% (predicted)	43/113	25/42	2.3	0.02
FEV ₁ ≥ 80% (predicted)	70/113	17/42	–	–
Nijmegen score > 20 (n = 11)*	4/19	7/11	6.5	0.04
Nijmegen score < 20 (n = 19)	15/19	4/11	–	–
ACT score < 16 (n = 45; overall n = 91) [†]	29/65	12/26	1.0	0.81
ACQ5 score > 1.5 (n = 48; overall n = 91) [†]	13/65	13/26	4.0	0.01
BD response ≥ 12%	34/113	9/42	0.63	0.31
Atopy (SPT+)	23/113	12/42	1.57	0.28
FEV ₁ < 80% predicted plus ACQ > 1.5 (overall n = 91)	15/62	14/29	3.03	0.02
FEV ₁ < 80% predicted plus Nijmegen score > 20 (overall n = 30)	6/19	9/11	9.30	0.02

A unified hypothesis for VCD?

Hypothesis for VCD



From: Low et al, Clin Exp Allergy 2017



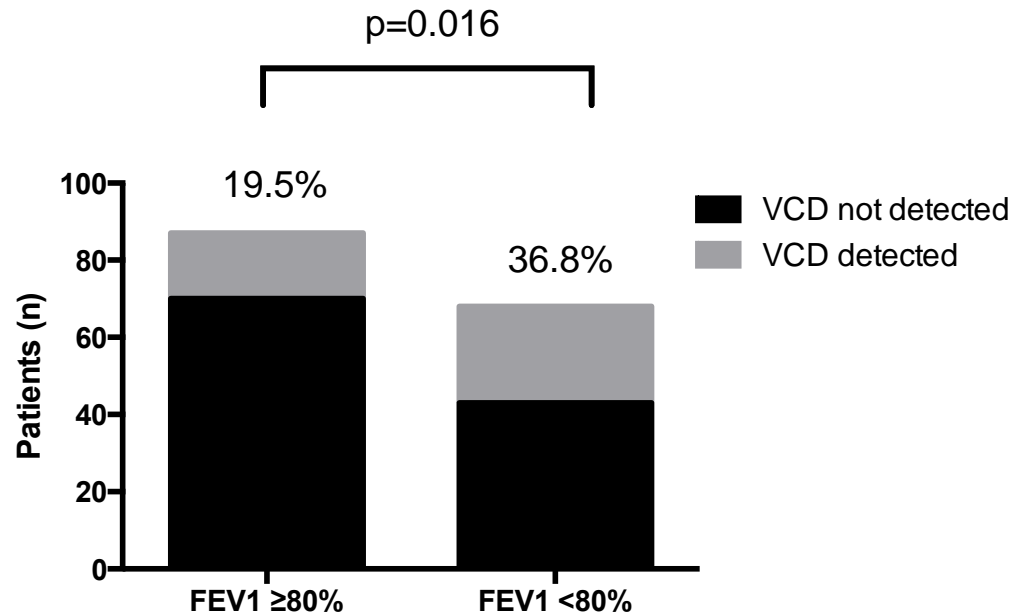
VCD and asthma

- VCD considered to exclude asthma diagnosis
- Various studies showed very strong associations: 40% (Low et al 2011) to >50% (Newman et al 1995)
- Recent 'consensus' ERS/ELS/ACCP: ILO excludes asthma (and vice versa!)

VCD in mild and severe asthma

	All patients (n = 155)	FEV ₁ ≥ 80% (n = 87)	FEV ₁ < 80% (n = 68)	P-value
Age (m ± SD)	53.6 ± 16.2	52.6 ± 15.6	54.8 ± 17.1	0.38
Gender (M/F)	42/113	26/61	16/52	0.47
BMI (kg/m ²)	30.5 ± 7.5	30.1 ± 7.0	31.1 ± 8.2	0.38
FEV ₁ (% predicted)	81.9 ± 25.1	100.2 ± 13.7	58.6 ± 15.1	< 0.0001
FEV ₁ /FVC (%)	70.33 ± 11.89	77.00 ± 6.71	61.78 ± 11.55	< 0.0001
TLco	81.78 ± 14.75	85.90 ± 11.81	76.38 ± 16.31	0.001
BD response (% change)	7.1 ± 10.3	4.1 ± 7.2	12.0 ± 11.7	< 0.0001
ACT score*	15.3 ± 5.8	17.2 ± 6.0	13.1 ± 4.5	0.005
ACQ5 score*	2.0 ± 1.3	1.3 ± 1.1	2.7 ± 1.2	< 0.0001
Nijmegen score [†]	24.1 ± 9.3	22.1 ± 9.3	25.8 ± 9.1	0.25
Medications				
SABA only	47/155	47/87	0/68	< 0.0001
ICS only	16/155	10/87	6/68	0.08
ICS and LABA	92/155	30/87	62/68	< 0.0001
Other [‡]	5/155	4/87	1/68	0.38

VCD is linked to airflow limitation



Low et al, Clin Exp Allergy 2017

VCD is associated with low FEV₁ and DB

Table 2. Association of patient and asthma disease features with PVCN

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VCD and asthma

- Links between VCD and asthma very strong
- More VCD in severe asthma
- Further research needed

Diagnosis of VCD

Rhino-Laryngoscope



Endoscopy:

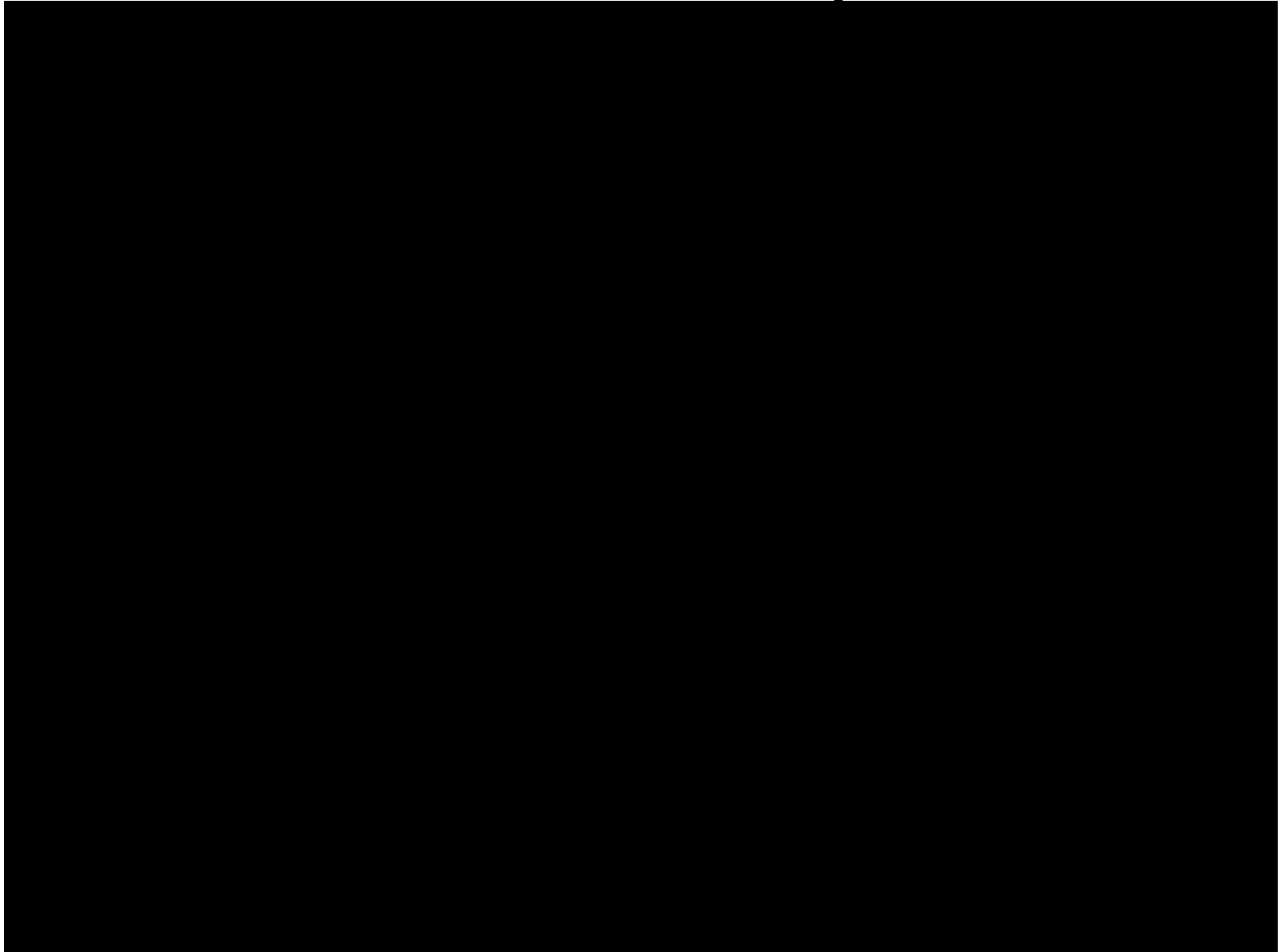
- Uncomfortable
- Lack of expertise and equipment to perform immediate endoscopy.
- Not quantifiable – and research difficult
- Poorly tolerated in many asthmatics with acute symptoms

Toshiba 320-slice CT

- Developed primarily for cardiac study
- Scans 16 cm 'volume' and obviates the need to 'stitch together' images.
- Resolution = 64 slice CT but superior detection of *movement and image reconstruction*



320 slice larynx



*



Aquilion ONE

FC07/
MonashHeart Southern Health

Original studies:

➤ Ten (10) difficult-to-treat asthmatics had 320-slice CT larynx

➤ 'VCD' in five (5)

➤ Radiation dose low (<2mSv)

ORIGINAL ARTICLE

Diagnosis of vocal cord dysfunction in asthma with high resolution dynamic volume computerized tomography of the larynx

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ABSTRACT

Background and objective: Vocal cord dysfunction (VCD) often masquerades as asthma and reports have suggested that up to 30% of patients with asthma may have coexistent VCD. Diagnosis of VCD is difficult, in part because it involves laryngoscopy which has practical constraints, and there is need for rapid non-invasive diagnosis. High speed 320-slice volume CT demonstrates laryngeal function during inspiration and expiration and may be useful in suspected VCD.

Methods: Endoscopy and high resolution 320-slice dynamic volume CT were used to examine and compare laryngeal anatomy and movement in a case of subglottic stenosis and in a patient with confirmed VCD. Nine asthmatics with ongoing symptoms and suspected VCD also underwent 320-slice dynamic volume CT. Tracheal and laryngeal anatomy and movement were evaluated and luminal areas were measured.

SUMMARY AT A GLANCE

Vocal cord dysfunction (VCD) often masquerades as asthma but diagnosis is difficult. In this study 320-slice dynamic volume CT was used to obtain explicit images of VCD. This will potentially provide a simple, non-invasive investigation to identify laryngeal dysfunction, permitting improved management of asthma.

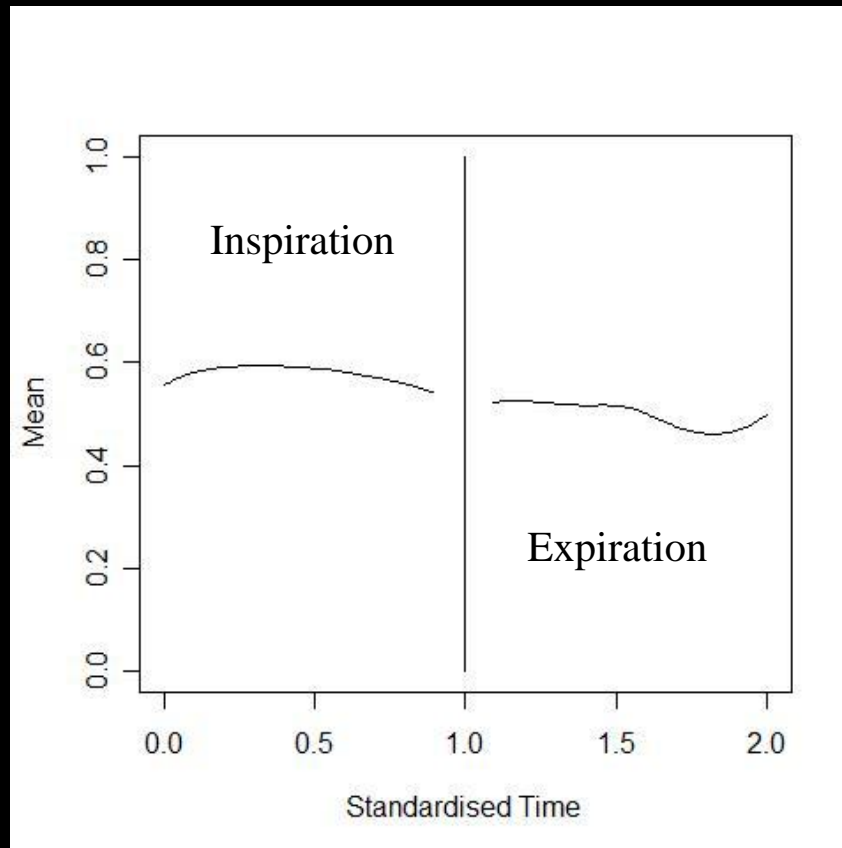
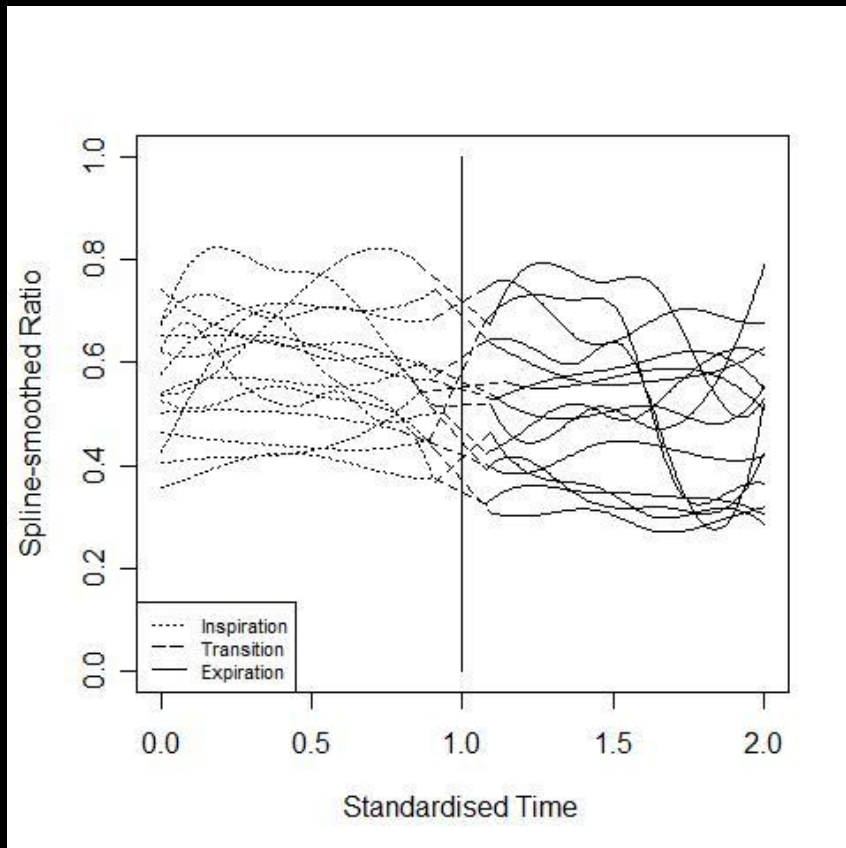
vocal cords during the respiratory cycle and could identify putative VCD. The technique will potentially provide a simple, non-invasive investigation to identify laryngeal dysfunction, permitting improved management of asthma.

Key words: 320-slice computerized tomography, asthma, diagnosis, non-invasive, vocal cord dysfunction.

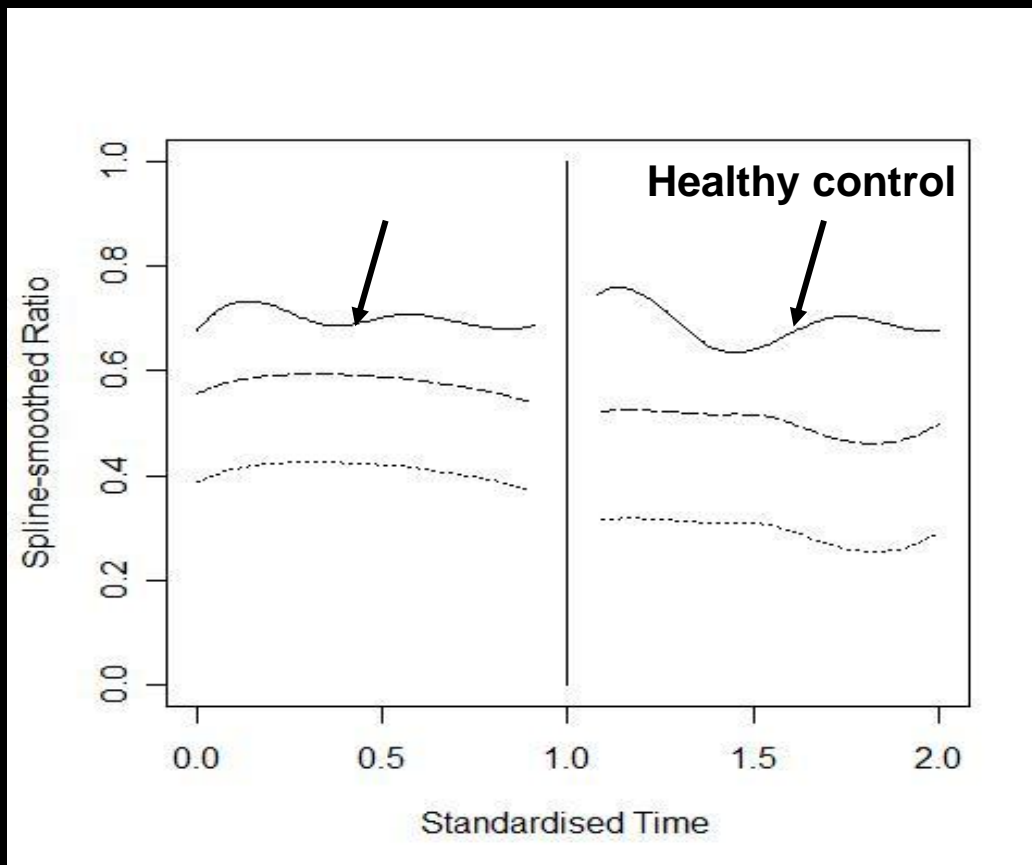
Quantifying VC movements

- 1. How to measure vocal cord behaviour**
- 2. Controlling for variable patient phenotypes**
- 3. Capturing movement of VC over time**

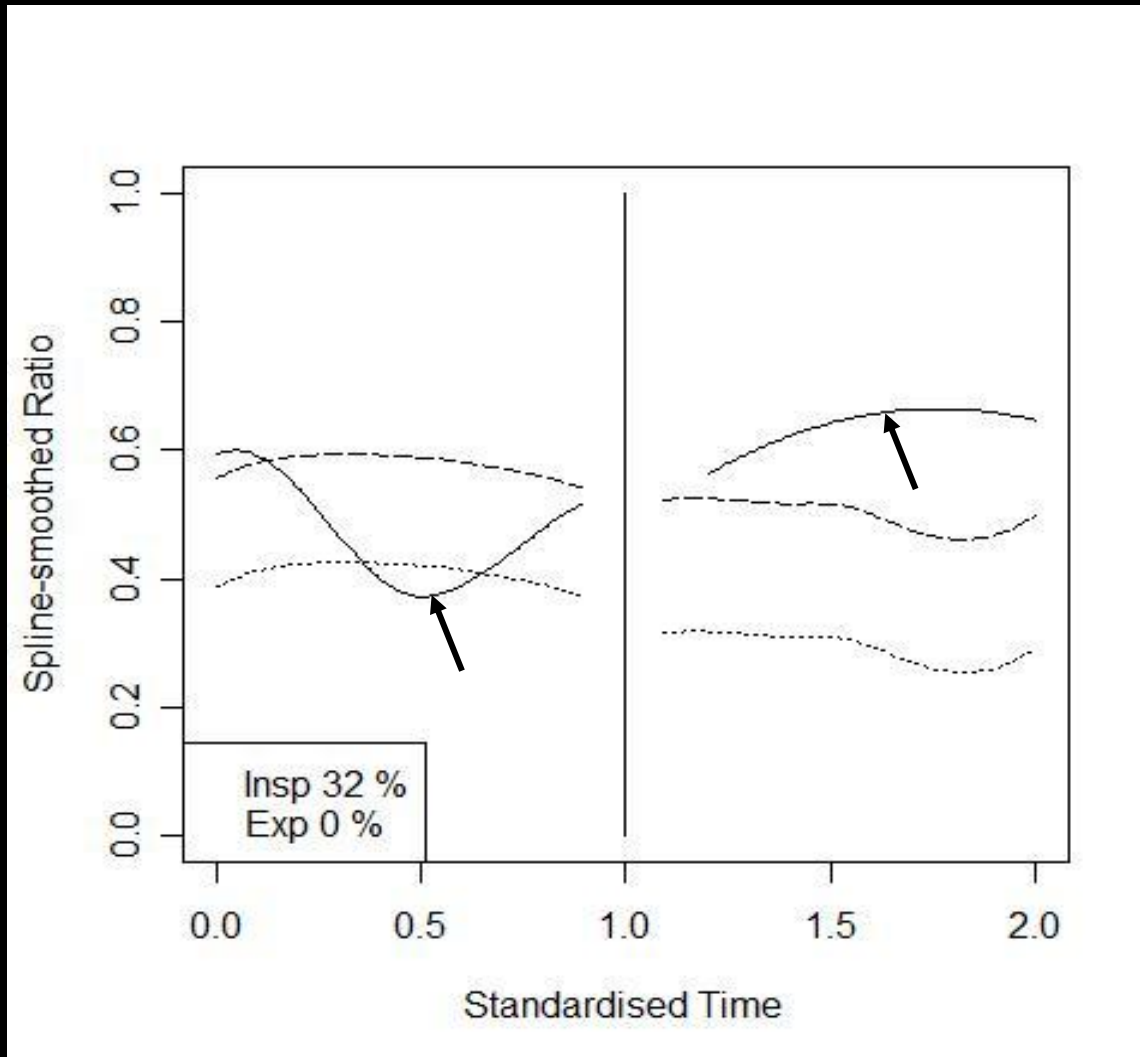
Normal RATIO (VC/trachea)



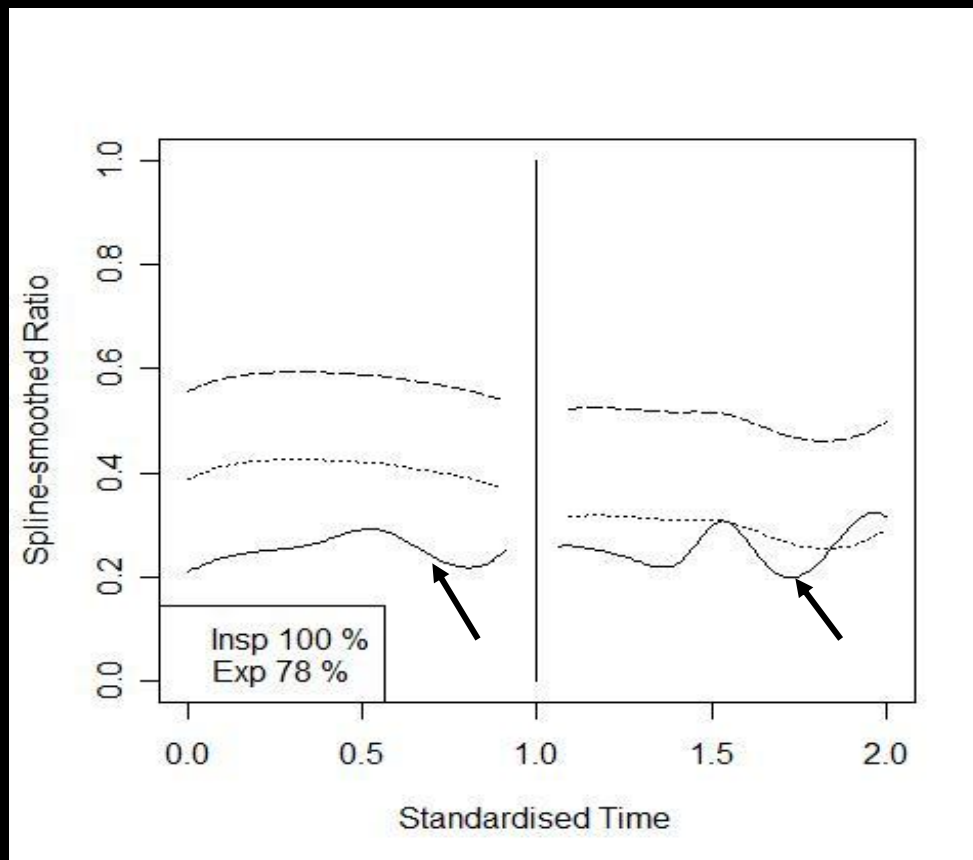
Normal vocal cord function



Inspiratory narrowing



Inspiratory and expiratory narrowing



Results of first studies

(Low et al, AJRCCM, 2011)

- VCD was present in 23 out of 46 asthmatics with severe asthma (50%)

(None of 36 normal individuals had abnormality)

Role of dynamic CT in VCD?

- Primarily research tool
- Quantification of VCD chief benefit
- Specific but not sensitive
- Clinical application as part of overall diagnostic assessment

Treatment?

There is no current standard of
care

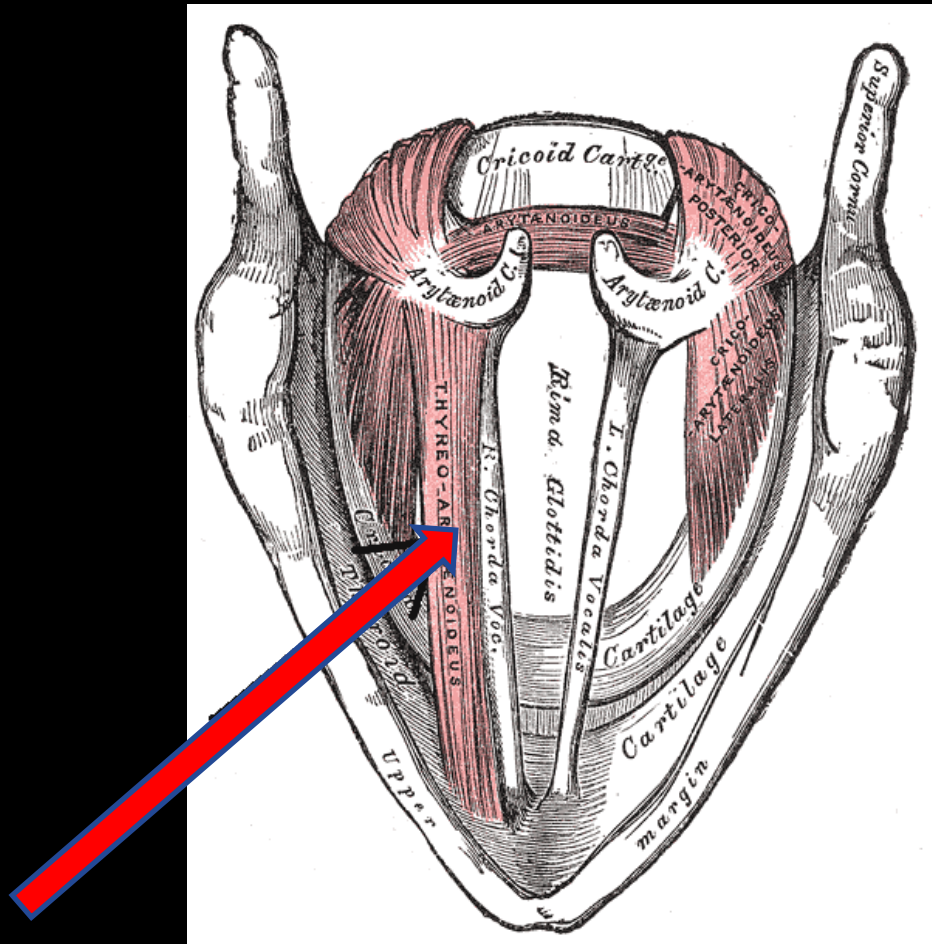
Speech Therapy

- Focus attention away from the larynx when breathing
- Encourage diaphragmatic breathing
- Promote vocal cord hygiene
- Encourage use of exercises for asthma symptoms

Botulinum toxin

- Botox®: botulinum toxin type A
- Purified neurotoxin that blocks conduction at motor and parasympathetic nerve terminals – prevents release of A-C with reversible paralysis
- Widely used to treat conditions of dystonia such as torticollis, writers cramp, blepharospasm – and vocal cord dystonia

'Direct' thyroarytenoid muscle injection



Method used for BT injection

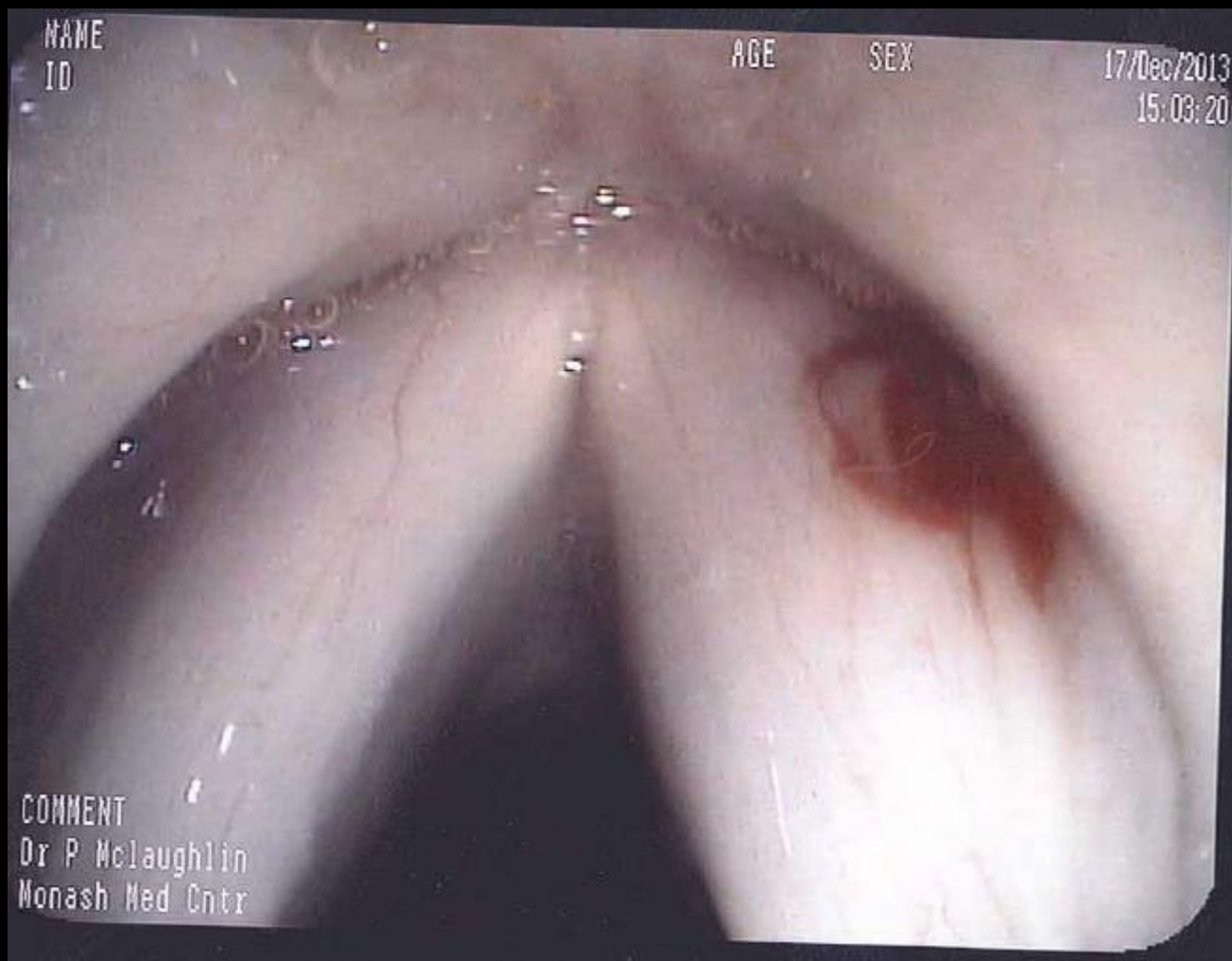
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COMMENT
Dr P McLaughlin
Monash Med Cntr



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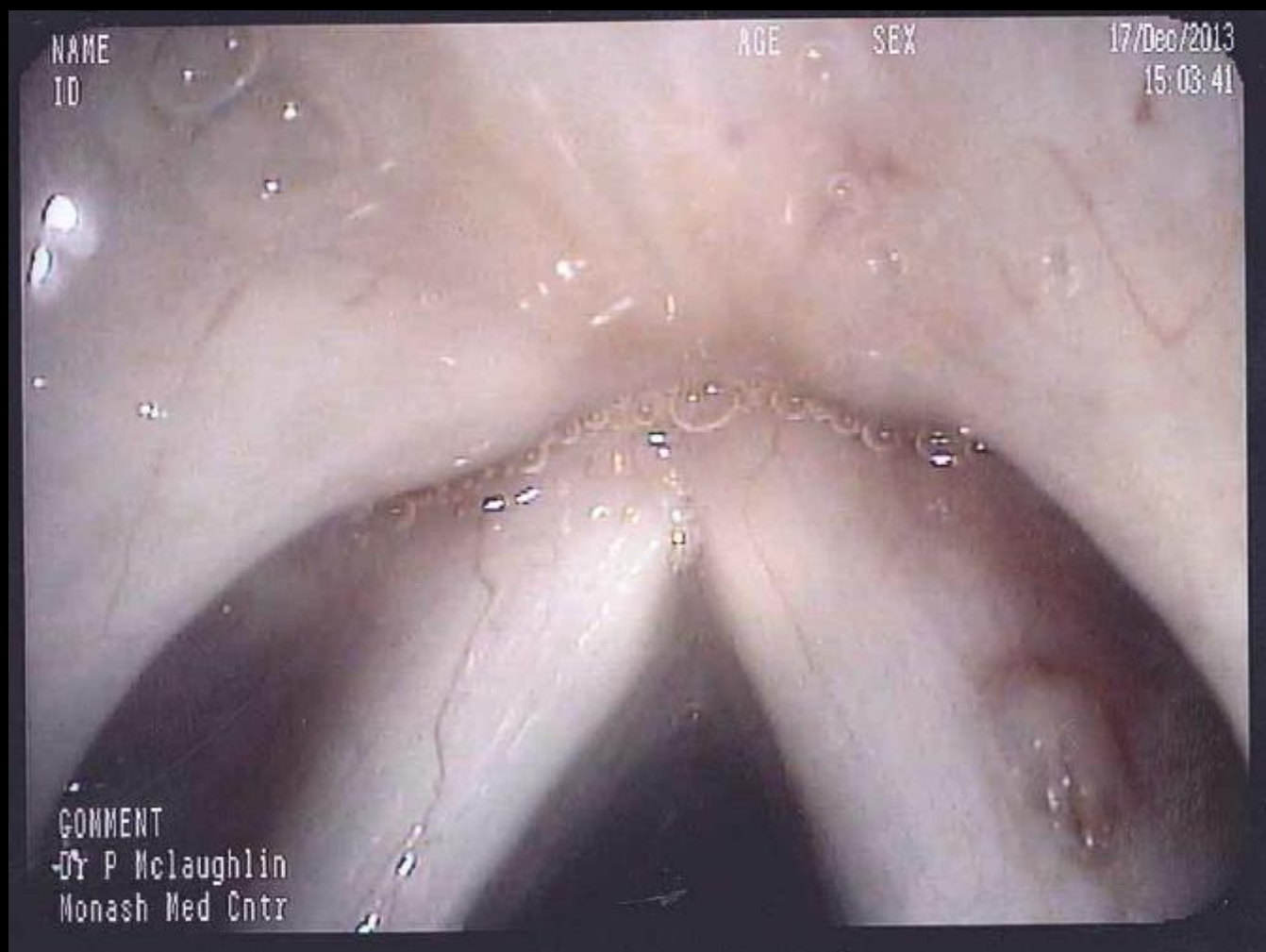
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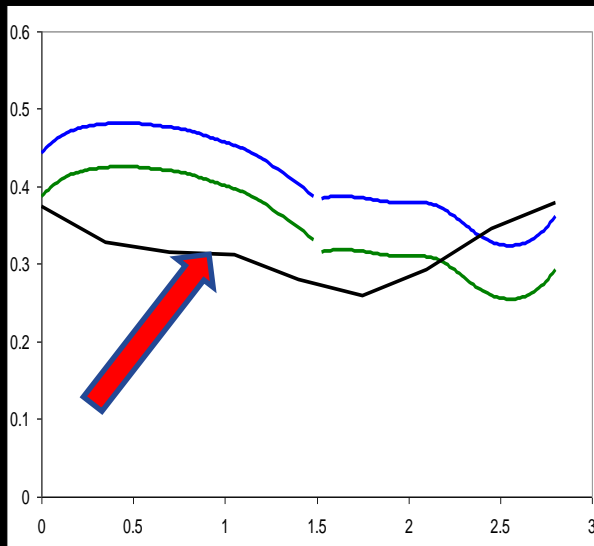
COMMENT

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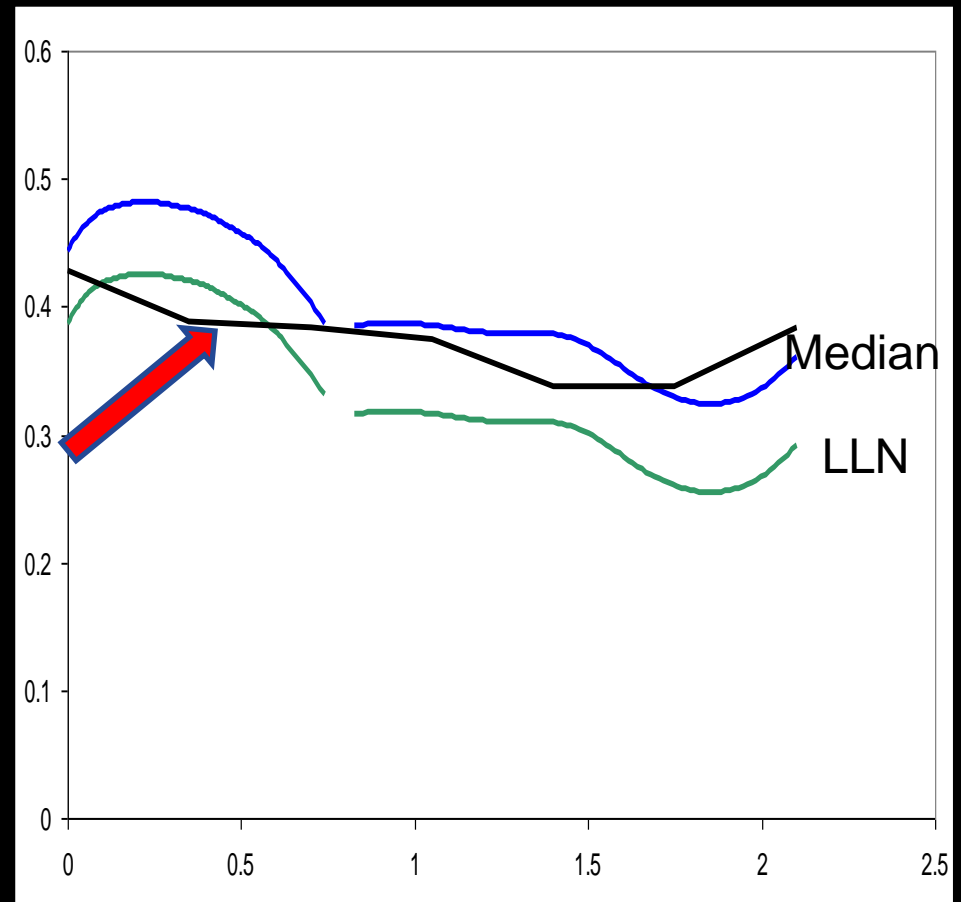


Response VCD to BT injection

Before



After



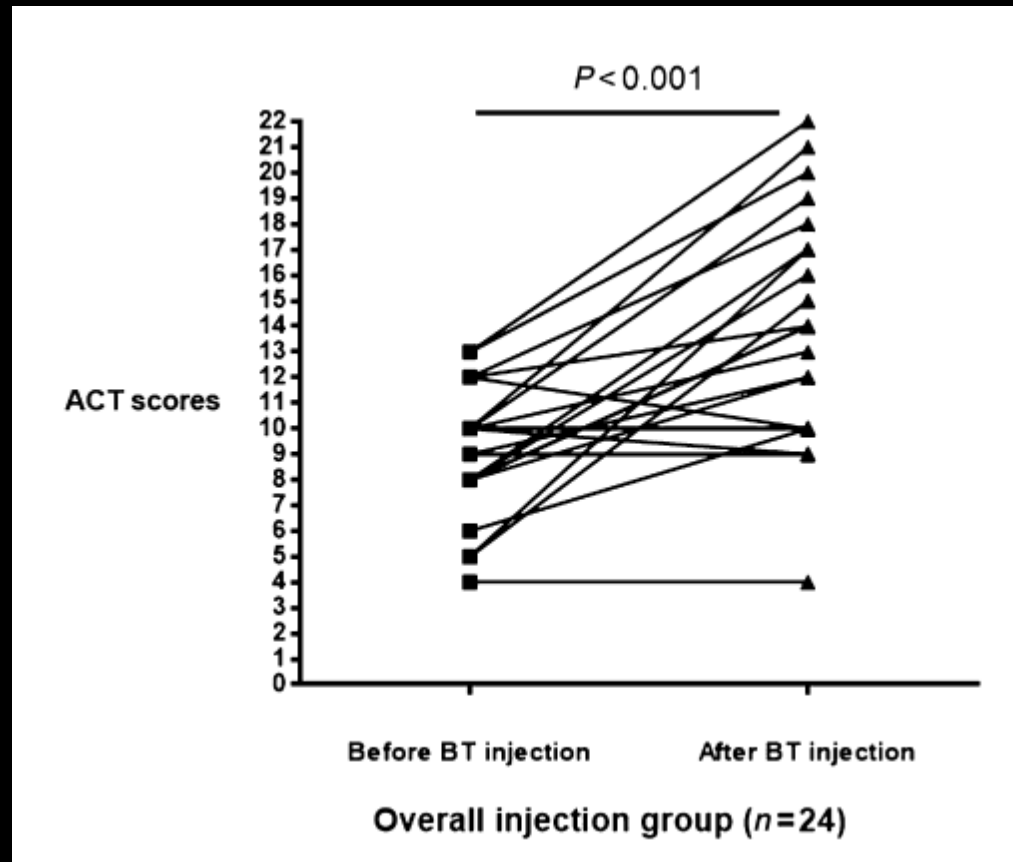
Abnormal vocal cord movement treated with botulinum toxin in patients with asthma resistant to optimised management

MALCOLM BAXTER,^{1*} NIZAM UDDIN,^{2*} SANJAY RAGHAV,³ PAUL LEONG,² KATHY LOW,² KAIS HAMZA,⁴
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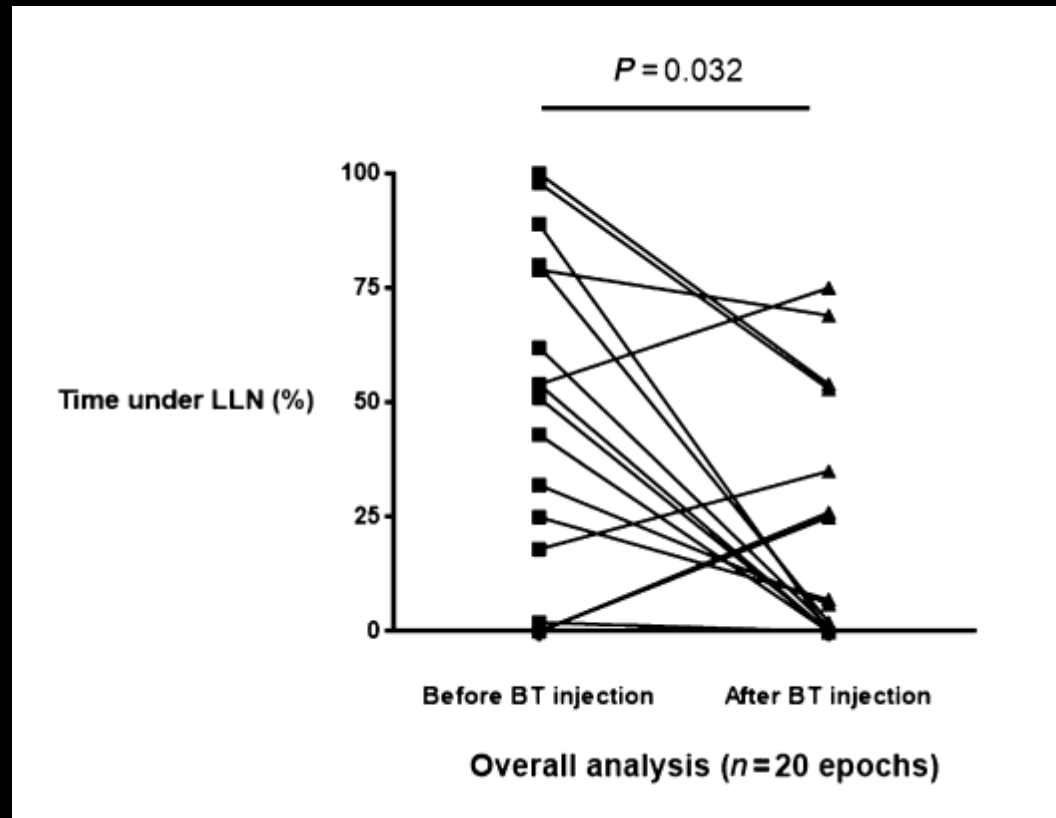
¹*Ear, Nose and Throat Surgery,* ²*Monash Lung and Sleep,* ³*Neurology,* ⁴*Statistics and* ⁵*Diagnostic Imaging, Monash Medical Centre and Monash Institute of Medical Research (MIMR), Monash University, Melbourne, Victoria, Australia*

Respirology (2014)
doi: 10.1111/resp.12271

Botulinum toxin improves asthma control score (n=24)

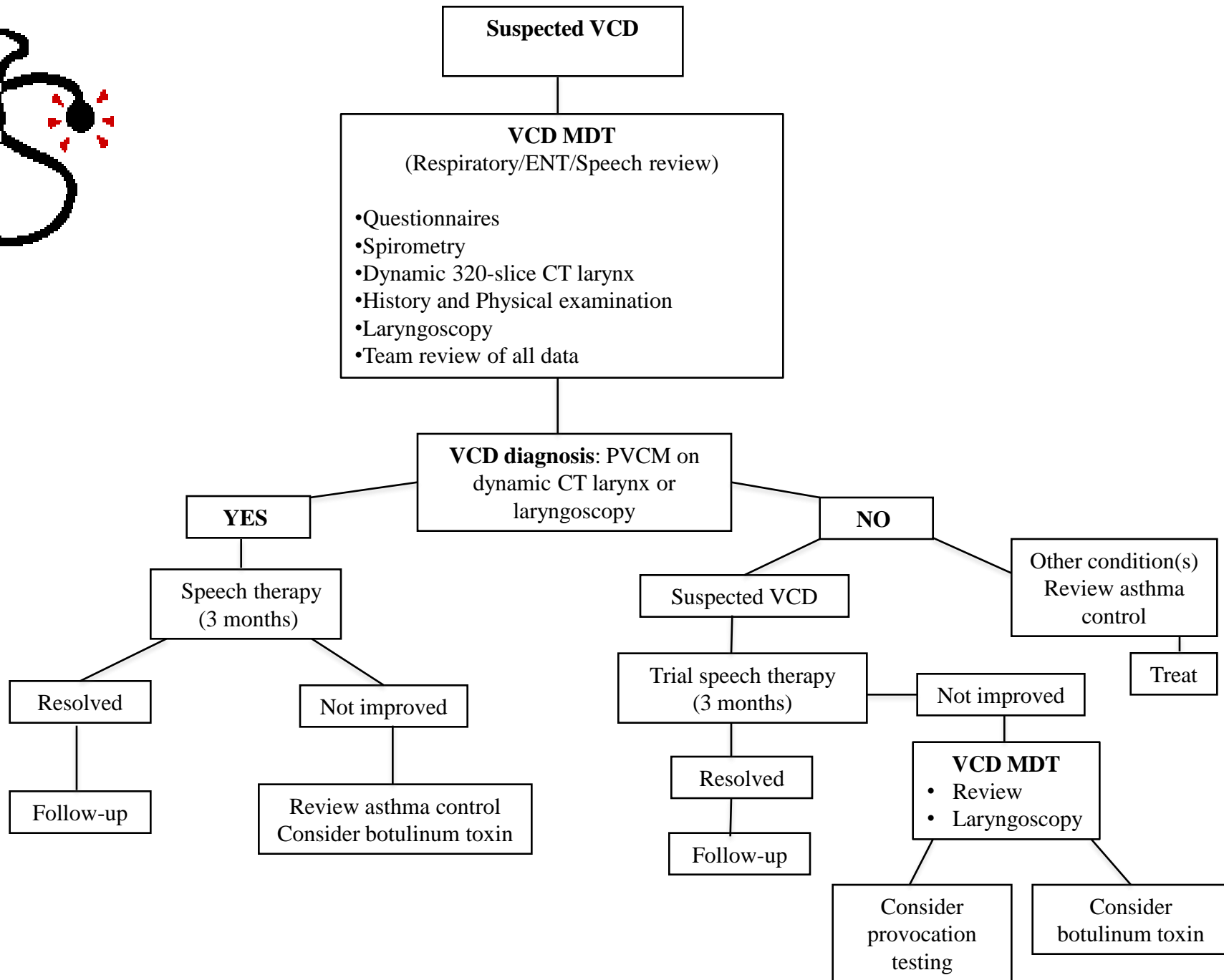
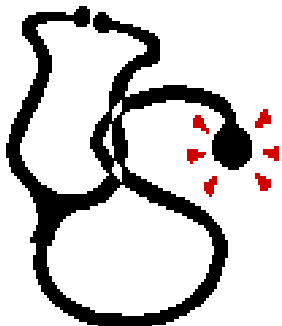


Botulinum toxin improves laryngeal function on CT (n=20)



What are the clinical consequences of this research?

- Started VCD-MDT Clinic at Monash, approx. 90 patients reviewed, appropriate management selected
- BT injection in selected cases, outcomes prospectively audited



Summary

- VCD may be the best name in the long term.....
- Diagnosis only in inspiration with PVCM
- Pathophysiology needs investigation
- VCD and asthma are closely related
- Diagnosis using CT useful for research
- Treatment needs further research

Contributors

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Questions & Answers



