



Government of **Western Australia**
South Metropolitan Health Service
Fiona Stanley Fremantle Hospitals Group

RESPIRATORY CONDITIONS AFFECTING SURGICAL OUTCOME

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INTRODUCTION

Respiratory patients have unique risk factors that can make surgery and anaesthesia challenging

- Abnormal lung mechanics
- Gas exchange abnormalities
- Pulmonary hypertension
- Comorbid conditions
- Frailty and cachexia



OUTLINE

CONDITIONS

- Obstructive sleep apnoea
- Chronic Obstructive Pulmonary Disease (COPD)
- Interstitial lung disease



OBSTRUCTIVE SLEEP APNOEA

Condition characterised by airway obstruction during sleep resulting in repeated oxygen desaturation and arousals.

Normal



During normal sleep, the muscles that control the tongue and soft palate hold the airway open.

Snoring



When these muscles relax, the airway narrows. This can lead to snoring and breathing difficulties.

OSA



If the muscles relax too much, the airway can collapse and become blocked, obstructing breathing.

Types of Sleep Apnea. Image sourced from Clinical Sleep Solutions Inc.



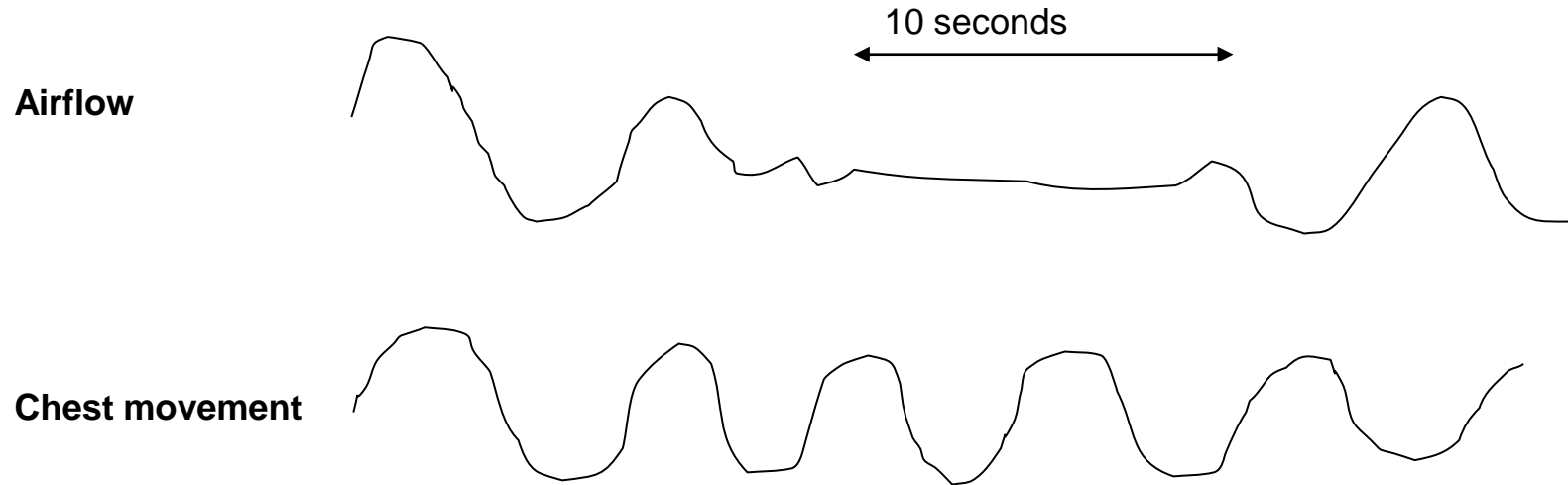
OBSTRUCTIVE SLEEP APNOEA

OSA impact on surgery

- Two to fourfold higher risk for perioperative complications compared to patient's without OSA
- Respiratory complications (oxygen desaturation, respiratory failure, difficult airway management)
- Cardiovascular complications (myocardial infarction, atrial fibrillation, stroke)



Obstructive apnoea



Hypopnoea

Oxygen



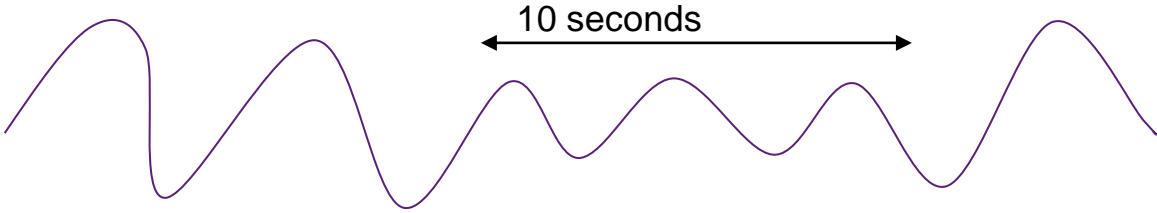
95%

85%

EEG



Airflow



10 seconds

Chest movement

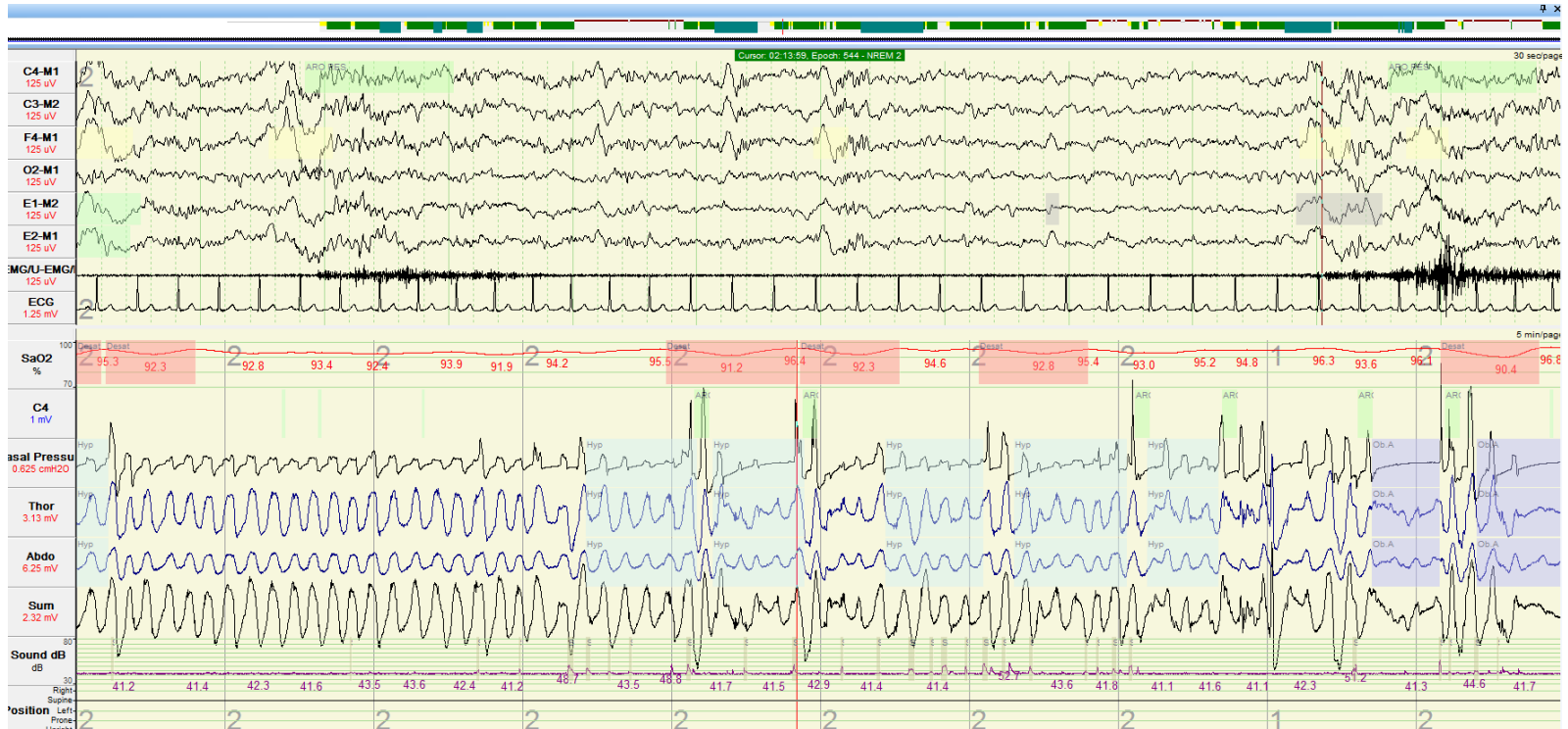


OSA diagnosis and severity

- AHI = (apnoeas + hypopnoeas) /hr slept
- Normal: AHI<5
- Mild OSA: AHI = 5-15
- Moderate OSA: AHI = 15-30
- Severe OSA: AHI>30

- Prevalence - clinically important Adult OSA = 6-17%

OBSTRUCTIVE SLEEP APNOEA



Sample Obstructive Sleep Apnoea reading



LAB BASED SLEEP STUDY



What it's like to spend the night in a sleep lab. Image sourced from Huffpost, Klein (2015).



Home sleep studies

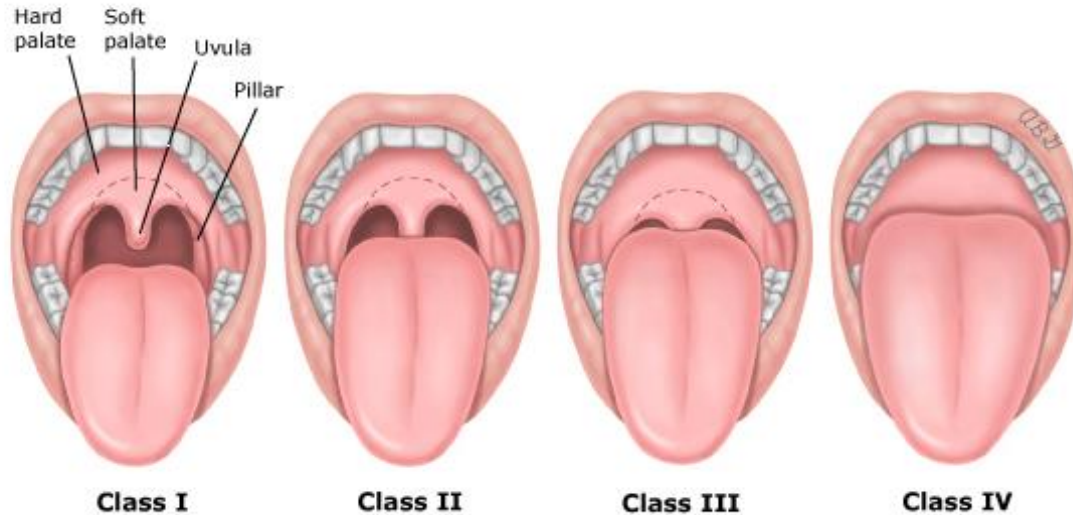


[Home Sleep Apnea Testing. Image sourced from Dream Sleep Testing.](#)



Upper airway anatomy

The modified Mallampati classification for difficult laryngoscopy and intubation



Samsoon GL, Young JR. Difficult tracheal intubation: a retrospective study. *Anaesthesia* 1987; 42:487



OSA: risk factors

Narrow upper airway



[Oropharyngeal Exam Predicts Severity of Sleep Apnea.](#) Image sourced from Medscape, Fox (2011).



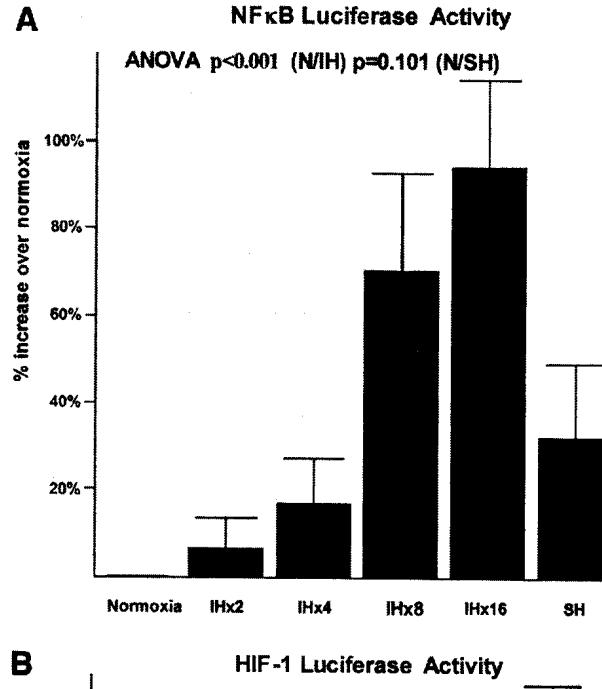
Sleep fragmentation

- Study exposed healthy volunteers to a sound every 2 mins which caused an EEG arousal
- Increased sleepiness, increased fatigue, decreased concentration, decreased mood compared to normal sleep
- Increased risk of motor vehicle accidents (X2-5 risk)

American Journal of Respiratory and Critical Care Medicine, Vol. 153, No. 4 | Apr 01, 1996



Intermittent hypoxia: Circulation



Intermittent hypoxia: Circulation, 2005, Ryan et al



OBESITY HYPOVENTILATION SYNDROME

Obesity

Hypoventilation

Absence of other conditions that can cause hypoventilation



OBSTRUCTIVE SLEEP APNOEA

Management of perioperative risk

- Pre surgery: Screen for undiagnosed sleep apnoea/OHS/pulmonary hypertension, optimise co-morbid conditions, continue OSA treatment until day of surgery and bring in OSA treatment devices
- Post surgery: Upright positioning, opioid sparing analgesic techniques, postoperative PAP therapy, postoperative monitoring



COPD

Heterogenous lung condition characterized by chronic respiratory symptoms (dyspnoea, cough, sputum production) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive airflow obstruction.

Diagnosis

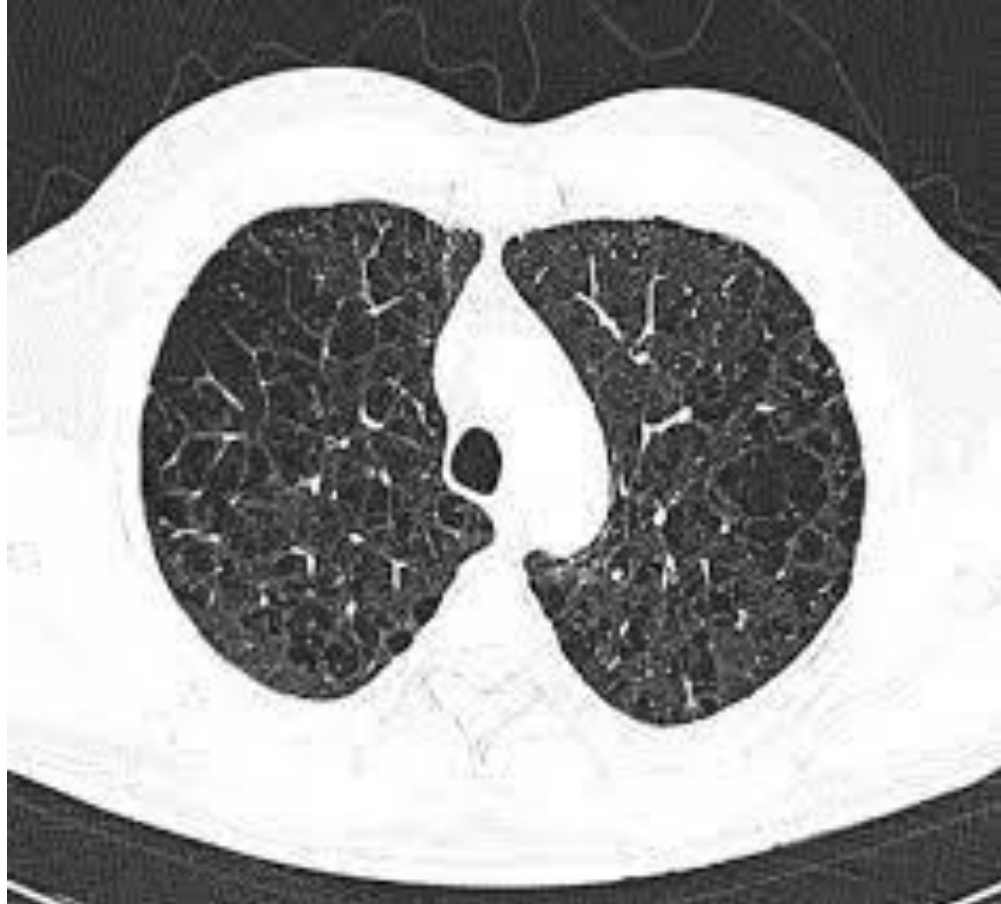
- Lung function testing: Spirometry: Reduced FEV₁, reduced FEV₁/FVC ratio, reduced DLCO (gas transfer), lung hyperinflation (increased total lung capacity), gas trapping (increased residual volume)



	Pre – Branch			Post – Branch		
	Actual	Pred	%Pred	Actual	%Pred	%Chng
SPIROMETRY						
FEV1 (L)	1.29	3.5	37	1.33	38	3
FVC (L)	4.8	4.51	106	4.87	108	1
FEV1/FVC (%)	27	78	35	27	35	
FEF 50% (L/sec)	0.41	4.56	9	0.45	10	10
FEF Max (L/sec)	2.13	9.05	24	2.62	29	23
LUNG VOLUMES						
RV(Pleth) (L)		2.16		3.09	143	
TLC (Pleth) (L)		6.77		7.97	118	
RV/TLC (Pleth) (%)		32		39	122	
SVC		4.51				
TGV		3.5		4.43	127	
DIFFUSION						
VA(L)		6.77		5.64	83	
DLCOunc (ml/min/mmHg)		27.02		14.67	54	
DLCOcor (ml/min/mmHg)		27.02				
DL/VA (ml/min/mmHg/L)		3.99		2.6	65	

Sample Pulmonary Function Tests results





Cuete D, Centrilobular pulmonary emphysema. Case study, Radiopaedia.org (Accessed on 20 May 2024) <https://doi.org/10.53347/rID-2680>

COPD

Disadvantageous lung physiology

- Loss of lung tissue resulting in loss of elastic tissue lung recoil
- Gas trapping, lung hyperinflation
- Bronchial wall inflammation/oedema, increased mucosal secretions
- Gas exchange disturbances (VQ mismatch)



COPD

Perioperative considerations in COPD

- Increased risk of pulmonary and cardiac complications
- Pre-anaesthesia optimisation: inhaled bronchodilators, pulmonary rehab, brief course oral glucocorticoid therapy, smoking cessation
- Avoidance of general anaesthetic if possible, lung protective anaesthesia
- Post-anaesthesia care: Resumption of bronchodilator therapy, use of incentive spirometry, early ambulation. Avoid over-oxygenation in patients at risk of hypoventilation



Interstitial lung disease

- Heterogenous group of disorders characterised by disorders that effect the lung interstitium
- Over time, if progressive these diseases cause the interstitium to thicken and develop fibrosis



Interstitial lung disease

Idiopathic pulmonary fibrosis: Chronic progressive scarring of the interstitium of unknown cause (idiopathic)

Non specific interstitial pneumonitis (NSIP): ILD that often occurs with autoimmune diseases (scleroderma, rheumatoid arthritis, dermatomyositis)

Asbestosis: Caused by asbestos exposure

Sarcoidosis: Granulomas occur in various tissues (most commonly in lungs and thoracic lymph nodes)





Cottin, et al., (2014). Diagnosis and Management of Idiopathic Pulmonary Fibrosis: French practical guidelines. *European respiratory review : an official journal of the European Respiratory Society*. 23. 193-214. 10.1183/09059180.00001814.

Interstitial lung disease

Fibrosis causes increased lung recoil and reduced gas transfer

	Pre – Bronch			Post – Bronch		
	Actual	Pred	%Pred	Actual	%Pred	%Chng
SPIROMETRY						
FEV1 (L)	2.78	3.09	90	2.89	94	4
FVC (L)	3.38	4.15	81	3.43	83	1
FEV1/FVC (%)	82	75	109	84	112	2
FEF 50% (L/sec)	4.09	3.63	113	4.33	119	6
FEF Max (L/sec)	8.02	7.92	101	7.9	100	
LUNG VOLUMES						
RV(Pleth) (L)	1.07	2.62	41			
TLC (Pleth) (L)	5.38	7.22	75			
RV/TLC (Pleth) (%)	20	38	53			
SVC	4.3	4.15	104			
TGV	3.87	3.89	99			
DIFFUSION						
VA(L)		7.22		5.04	70	
DLCOunc (ml/min/mmHg)		33.67		13.87	41	
DLCOcor (ml/min/mmHg)		33.67				
DL/VA (ml/min/mmHg/L)		4.66		2.75	59	

“Spirometry reference equations GLI-2012”

Sample Pulmonary Function Tests results



Interstitial lung disease

- Pre anaesthetic: Optimise respiratory function, assess for pulmonary hypertension, pulmonary rehabilitation, weigh up risk/benefit ratio of surgery
- Intra-operative management: Sitting position, if possible, low tidal volumes (avoid high inspiratory pressures)
- Post-operative management: Ensuring adequate anaesthesia, prevention of atelectasis, respiratory support as needed



Take home messages

- Respiratory patients have a unique set of perioperative risks
- Careful screening, assessment and optimization of respiratory patients prior to surgery is important
- Risk/benefit assessment

