DYSPNEA

Dr. Rajneesh.A.R
Junior resident
Internal medicine

DYSPNEA – Mechanisms, Approach and Therapy

- Definition
- Causes
- Mechanisms
- Approach
- Management options

Definition

- *"A subjective experience of breathing discomfort that is comprised of qualitatively distinct sensations that vary in intensity.*

  The experience derives from interactions among multiple physiological, psychological, social and environmental factors and may induce secondary physiological and behavioural responses."

The American Thoracic society

Dyspnea

- breathing is difficult, laboured or uncomfortable
- subjective
- awareness of need for increased respiratory effort
- ventilatory demands > ventilatory capacity

Classification

- by severity
- by aetiology
- whether exertional or at rest
- by mode of onset and progression

Physiologic categories of diseases causing dyspnea

- Mechanical interference with ventilation
- Weakness of the respiratory pump
- Increased respiratory drive
- Increased wasted ventilation
- Psychological dysfunction

Mechanical interference

- Obstruction to airflow- asthma, endobronchial tumour
- Stiff lungs – interstitial fibrosis, LVF
- Resistance to expansion of chest wall/diaphragm- kyphoscoliosis, obesity, abdominal mass

Weakness of respiratory pump

- Absolute - neuromuscular diseases
- Relative - muscle at a mechanical disadvantage

hyperinflation, pneumothorax, effusion

Increased respiratory drive

- hypoxemia of any cause, ↓ CO, Hb
- Metabolic acidosis
- Stimulation of intrapulmonary receptors

Increased wasted ventilation

- Capillary obstruction (emphysema, ILD)
- Large vessel obstruction (PE, vasculitis)

Psychological dysfunction

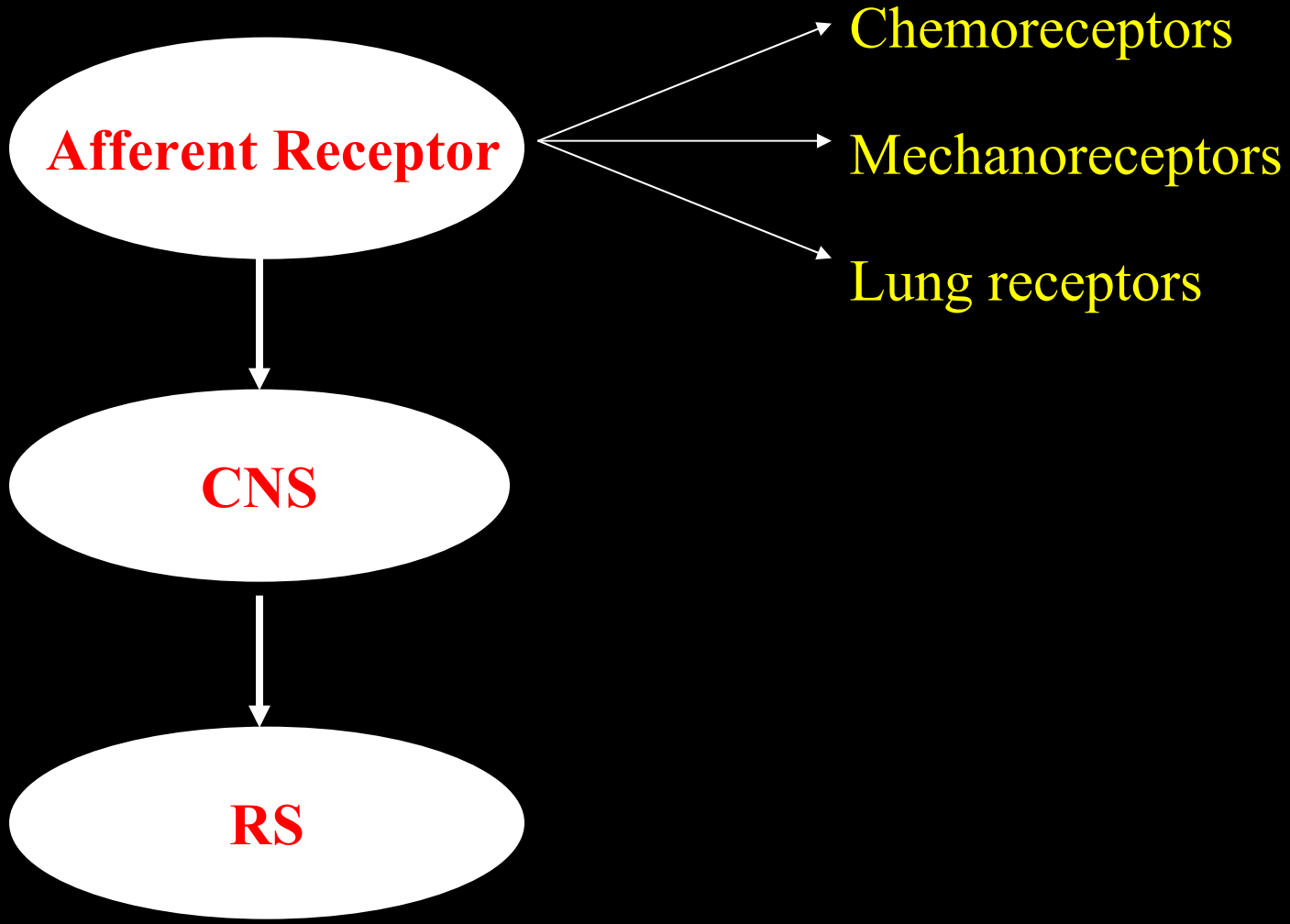
- Anxiety
- Depression
- Somatization
- Alleged respiratory injury

Mechanisms

- Dyspnea is a perception
- “an urge to breath”/ air hunger
- “a sense of excessive effort” a/w breathing

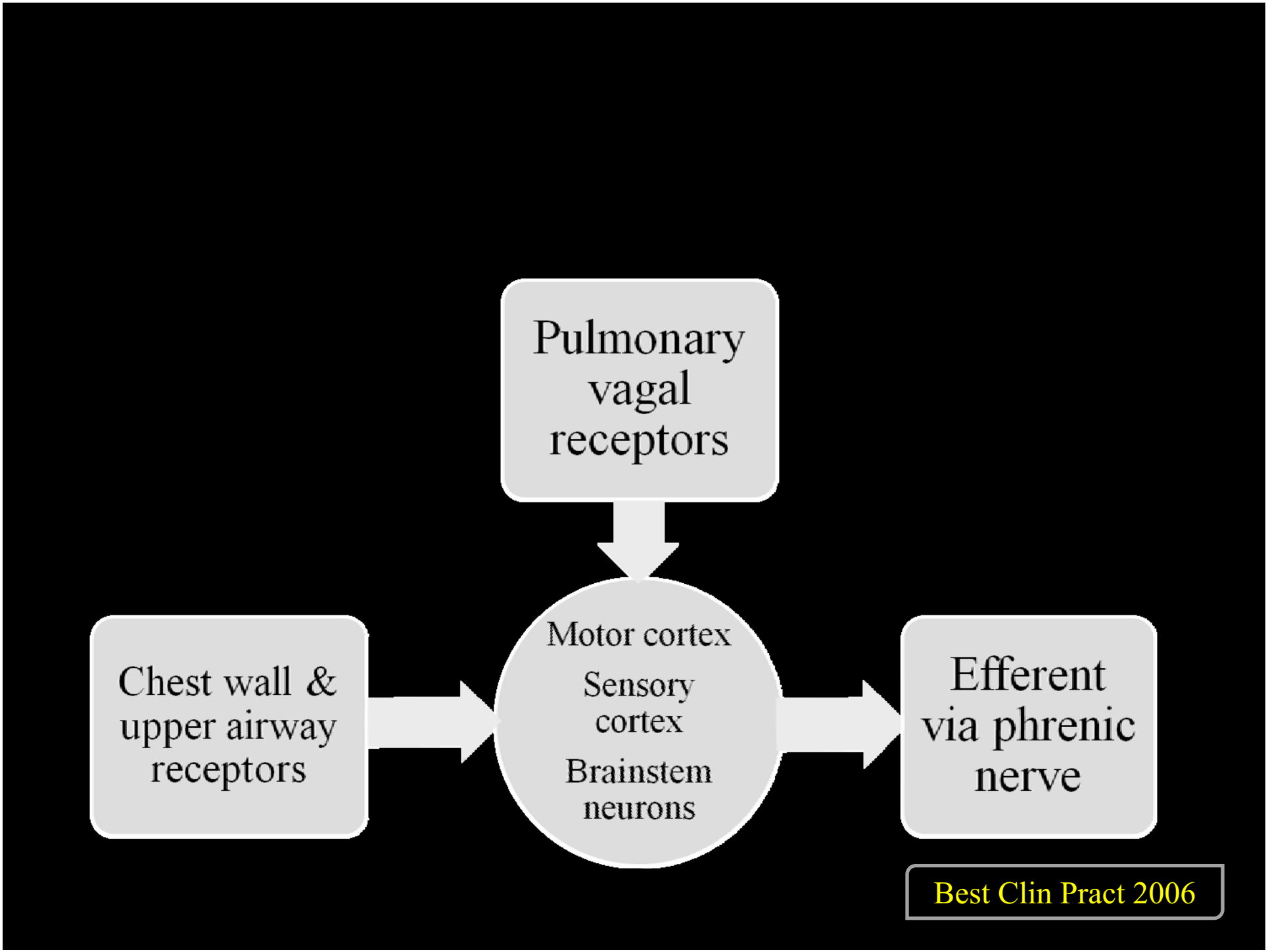
- Dyspnea depends to a large extent on the degree to which respiratory related neurons in the brainstem are stimulated
- NIV in COPD- reduces the work of breathing and the efferent neural activity to respiratory muscles

MECHANISMS


Afferent Receptor
Chemoreceptors
Mechanoreceptors
Lung receptors
CNS
RS

Chemoreceptors

Medulla	• Detects hypercarbia
Carotid & aortic body	• Detects hypoxia


Pulmonary vagal receptors
Chest wall & upper airway receptors
Motor cortex
Sensory cortex
Brainstem neurons
Efferent via phrenic nerve
Best Clin Pract 2006

- *‘‘length-tension inappropriateness’’*

Campbell & Howell, 1963

disassociation between the force or tension generated by the respiratory muscles and the lung volume generated by that force.

- *‘‘neuromechanical dissociation’’*

dissociation between the motor command and the mechanical response of the respiratory system.

Prim Care Clin
Office Pract 2006

HEART DISEASES

LV dysfunction

Elevated pulmonary capillary pressure

↓

Transudation of fluid into interstitium

↓ complaince of lungs

Stimulates ***J receptors*** in alveolar interstitial space

↓

If prolonged

Thickening of walls of small pulmonary vessels &

↑ perivascular cells & fibrous tissue

↑airway resistance

↓

Hydrothorax

↓

DYSPNEA

APPROACH

- Comprehensive medical history
- Recognize whether its dyspnea or not (fatigue, weakness, chest pain)
- Persistence and variability of the symptom
- Episodic nature
- Diurnal variation, positional variation(platypnea ; trepopnea)
- Orthopnea , PND, PND equivalents
- Aggravating/ precipitating & relieving factors
- Medications, Exercise, Emotions

Patient's description

breathlessness

shortness of breath

chest tightness

work/effort

unrewarded inspiration

rapid breathing

air hunger

… … … … … … … … …

Acute Dyspnea.....

Cardiac

- **Heart failure, Myocardial infarction, Tamponade**

Respiratory

- **Asthma**
- **COPD**
- **Pneumonia**
- **Pneumothorax**
- **PTE**
- **Foreign body**
- **Inhalation of toxic gases, Angioedema larynx**

Acute renal failure

Diabetic ketoacidosis

Septicemia

Other metabolic acidosis

Intracranial events

Evaluation of acute dyspnea

- brief history of cardiac and pulmonary disease
- breathing pattern and rate
- Able to answer your questions
- note use of accessory muscles
- cardiac rhythm
- vital signs
- pulse oximetry
- mental status
- assessment of airway patency
- auscultation of the lungs

Examination…….

- Clubbing
- Pallor
- Cyanosis
- Edema – symmetric (CCF), asymmetric (PTE)
- Jugular venous distention
- an enlarged thyroid gland
- adenopathy
- shift of the trachea
- chest wall shape, deformity(kyphoscoliosis, excavatum, ankylosing spondylitis)

Palpate for

- subcutaneous emphysema, crepitus

Percuss for

- dullness - consolidation or effusion
- hyperresonance - pneumothorax or bullous emphysema

Auscultate for

- stridor
- intensity, timing of the respiratory phases, & any adventitial sounds
- absent breath sounds (pneumothorax or pleural effusion)
- wheezing (asthma, COPD, & left vent failure)

CVS

- rapid or irregular pulse
- point of maximal impulse
- heart murmur
- gallop
- loud P2, S3, S4

- CXR → cardiac size, configuration; lung parenchyma; pulmonary vasculature; pleural space; mediastinum; position of diaphragm
- ECG → ischemia; arrhythmias; chamber size
- Counts …….. anemia; polycythemia; infection
- PFT – FEV_1 ; FEV_1/FVC; PEFR
- pulse oxymetry

Echocardiogram
chamber size
ventricular function
valvular function
possible pericardial effusion
estimate of pulm artery systolic pressure

Markers of CCF
ANP
BNP

D-dimer for PTE
Electrolytes

Once an emergent situation has been excluded

Detailed history
& Physical examination
Appropriate laboratory testing

Characterize Dyspnea ……

onset

frequency

intensity

duration

triggers (exposures)

provoking activities (ambulation, eating, changing position)

strategies or actions (medications, positions) that provide relief

HISTORY.....

Acute and chronic lung diseases

acute and chronic cardiac disease

history of anemia, blood transfusions

neuromuscular diseases

abdominal swelling, edema

connective tissue disorders

OSA

- Intermittent dyspnea with wheeze - asthma or CHF
- Orthopnea – CHF, asthma, COPD, B/L diaphragmatic palsy
- Persistent or progressive dyspnea - COPD, interstitial fibrosis, or pulmonary hypertension
- Nocturnal dyspnea - asthma, CHF, or gastroesophageal reflux
- Dyspnea occurring mainly after exercise suggests exercise-induced asthma
- Repeated episodes at rest + near syncope on exertion, source for emboli - PVOD
- Dyspnea occurring independent of physical activity – allergic or mechanical problems, psychological(frequent sighing & irregular breathing)

Cough combined with a change in character of sputum - exacerbation of COPD

Fever, sore throat, & acute dyspnea – epiglottitis

Chest pain during dyspnea - coronary or pleural disease, depending on the quality and description of the pain

Pleuritic chest pain - pneumothorax, pulmonary embolism, pneumonia, or pleuritis

Anginal chest pain - ischemia associated with left ventricular dysfunction

Additional information - cigarette smoking, occupation, current or previous inhalational exposures, hobbies

Evaluation of chronic dyspnea

History

- onset
- frequency
- duration
- triggers
- strategies that provide relief

- Intermittent dyspnea -bronchospasm, pleural effusion, CHF, chronic recurrent thromboemboli
- Progressive dyspnea - COPD, neuromuscular disorders, or interstitial lung disease
- Associated symptoms - cough, sputum, wheezing, orthopnea, chest pain, heartburn, & PND

Sensation	COPD	CCF	ILD	Asthma	NM & Chest wall	Pregnancy	Pulm vasc
Rapid breathing		X					X
Incomplete exhalation				X			
Shallow breathing				X	X		
↑work/effort	X		X	X	X		
Feeling of suffocation	X	X					
Air hunger	X	X				X	
Chest tightness				X			
Heavy breathing				X			

Testing in chronic dyspnea should be targeted in attempt to answer specific questions

- ***Asthma or COPD or restrictive lung disease – spirometry***
- ***Bronchoprovocation - reactive airways***
- ***Flow volume loops -upper airway obstruction***
- ***DLco - abnormal pulmonary gas exchange***
- ***Normal spiromety & lung volumes but ↓ DLco, - anemia, early ILD & pulm vascular disease***
- ***PImax & PEmax - neuromuscular causes of dyspnea***

Cardiac causes
ECG
Echocardiogram
CXR

Cause unclear despite above protocol - spirometry and diffusing capacity, a CXR, a resting 12-lead EKG, and oximetry as initial screening tests

If the results of these tests are normal anxiety/hyperventilation, deconditioning, respiratory muscle weakness

Etiology still unclear

cardiopulmonary exercise testing (CPET)

can localise problem to pulmonary or cardiac system

can point to deconditioning, or peripheral vascular or muscular disease

Less commonly used tests

ventilation perfusion scanning (chronic thromboembolic disease)

TFT (occult hyper- or hypothyroidism)

gallium scanning (inflammatory lung disease or infection)

Modified MRC Dyspnea Scale	
Category 0	No dyspnea
Category 1	Slight degree of dyspnea *(troubled by shortness of breath when hurrying on the level or walking up a slight hill)*
Category 2	Moderate degree of dyspnea *(walks slower than people of the same age on the level because of breathlessness)*
Category 3	moderately severe degree of dyspnea *(has to stop because of breathlessness when walking at own pace on the level)*
Category 4	severe degree of dyspnea *(stops for breath after walking about 100 meters or after a few minutes on the level)*
Category 5	very severe degree of dyspnea *(too breathless to leave the house or breathless when dressing or undressing)*

Subject marks a point on the line in response to a question (eg. How short of breath are you right now?)

The score is determined by the length of the line from "not breathless" to the point marked by the patient

Modified Borg Category Scale for Rating Dyspnea

Rating	Intensity of Sensation
0	Nothing at all
0.5	Very, very slight (just noticeable)
1	Very slight
2	Slight
3	Moderate
4	Somewhat severe
5	Severe
6	
7	Very severe
8	
9	Very, very severe (almost maximal)
10	Maximal

Other methods

- The oxygen cost diagram
- Baseline dyspnea index
- Transition dyspnea index
- University of California at San Diego shortness of breath questionnaire
- The Saint George respiratory questionnaire
- The pulmonary functional status scale
- The pulmonary functional status & dyspnea questionnaire
- The chronic respiratory disease questionnaire

Oxygen therapy

- Depress VE by depressing the hypoxic drive (mediated by carotid body chemoreceptors)
- Blunt the pulmonary artery pressure rise a/w exercise, ↓afferent input
- Improves ventilatory muscle function
- High flow rates 4-6 L/min may be optimal
- Transtracheal route provide greater relief (↓ VE, work of breathing, stimulation of flow receptors in large airway)

Pharmacological therapy

- Opiates

Opiates are known respiratory depressants that reduce the central processing of neural signals within the CNS and reduce VE, both at rest and during submaximal levels of exercise. It also blunts the perceptual responses.

Inhalation of opiates – stimulates opioid receptors in the resp tract.

- Anxiolytics

Depresses hypoxic or hypercapnic ventilatory responses, alters emotional responses.

Newer modalities for dyspnea perception

- PET scan
- MRI

- Activation of limbic & paralimbic structures
- Dypnea is a primal experience a/w behaviors intended to counteract a threat to survival