

Case Conference

2010/06/05

Presented by R1 蘇誌鋒
Supervised by F1 黃婷韻

Discussion

1. Control of breathing
2. Hyperventilation
3. Acute delirium

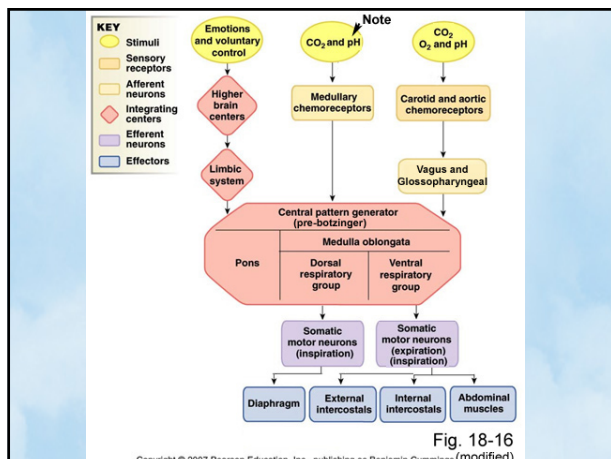
Control of ventilation

• Receptors in lungs

- 1) Slowly adapting stretch receptors (pulmonary stretch receptors)
 - Receptors between smooth muscle cells in large airways.
 - Large myelinated fibres within vagus.
 - Respond mainly to stretch, with slow adaptation.
 - Reflex effects are: inhibition of inspiration (the 'Hering-Breuer' reflex and bronchodilation).
- 2) Rapidly adapting stretch receptors (irritant receptors).
 - Receptors between epithelial cells in large airways.
 - Small myelinated fibres within vagus.
 - Respond to stretch with rapid adaptation. Also to irritants (e.g. smoke, histamine) within airway.
 - Reflex effects: cough, bronchoconstriction and tachypnoea.
- 3) J-receptors (juxtacapillary receptors)
 - Receptors by alveoli and capillaries.
 - Unmyelinated (C) fibres within vagus.
 - Stimulated by edema in interstitium of lung - a 'visceral pain' receptor.
 - Reflex effects: **rapid shallow breathing**.

Control of ventilation

- peripheral chemoreceptors
 - carotid and aortic bodies
 - the primary sites for sensing the partial pressure of arterial oxygen (PaO₂), but they also increase their discharge in response to hypercapnia or acidosis.
- Central nervous system chemoreceptors
 - respond to changes in pH of the CNS environment
 - the ventral surface of the medulla



Definition of hyperventilation

- A minute ventilation (determined by respiratory rate and tidal volume) that exceeds metabolic demand.
- Arterial blood gases characteristically show a normal partial pressure of oxygen with an uncompensated respiratory alkalosis
 - low partial pressure of carbon dioxide
 - elevated pH

Causes of Respiratory Alkalosis

- **Central Causes (direct action via respiratory center)**
 - Head Injury
 - Stroke
 - Anxiety-hyperventilation syndrome (psychogenic)
 - Other 'supra-tentorial' causes (pain, fear, stress, voluntary)
 - Various drugs (eg methylxanthine, salicylate intoxication)
 - Various endogenous compounds (eg progesterone during pregnancy, cytokines during sepsis, toxins in patients with chronic liver disease)
 - tumor
- **Hypoxaemia (act via peripheral chemoreceptors)**
 - Respiratory stimulation via peripheral chemoreceptors
- **Pulmonary Causes (act via intrapulmonary receptors)**
 - Pulmonary Embolism
 - Pneumonia
 - Asthma
 - Pulmonary oedema (all types)
- **Iatrogenic (act directly on ventilation)**
 - Excessive controlled ventilation

Drug-induced respiratory alkalosis

- Salicylates: stimulate the medullary chemoreceptor directly
- methylxanthine, theophylline and aminophylline stimulate ventilation and increase the ventilatory response to carbon dioxide
- High progesterone levels increase ventilation and decrease the arterial PaCO₂ by as much as 5 to 10 mm Hg

Central Neurogenic Hyperventilation

- Diagnostic criteria for CNH
 - **hyperventilation that persists during sleep**, low arterial PaCO₂, high arterial PaO₂, and high arterial pH in the absence of drug or metabolic causes.
- infiltrative tumors involving the pontine tegmentum and medulla → activate central respiratory pathways that produce CNH
 - Lymphoma or slow-growing astrocytoma

Acute delirium

Diagnostic Criteria for Delirium

- **Disturbance of consciousness** (reduced clarity of awareness of the environment) with reduced ability to focus, sustain or shift attention
- **Change in cognition** (eg. memory deficit, disorientation, language disturbance) or development of a perceptual disturbance not due to pre-existing, established or developing dementia
- **The disturbance develops over a short period of time** (hours to days) and tends to fluctuate during the course of the day.
- **Evidence of etiology**

Comparative Features of Delirium and Dementia

	Delirium	Dementia
Onset	develops abruptly	develops slowly
Duration	brief, hours to days	chronic, months to yrs
Attention	impaired	normal, except in severe cases
Level of cons.	fluctuating	clear
Speech	incoherent, disorganized	ordered anomic/aphasic

NOTE: Disorientation and memory impairment may be present with both

CHARACTERISTIC	DELIRIUM	ACUTE PSYCHOSIS
Onset	Acute	Acute
Vital signs	Typically abnormal (fever, tachycardia)	Normal
Prior psychiatric history	Uncommon	Common
Course	Rapid, fluctuating	Stable
Psychomotor activity	Variable	Variable
Involuntary activity	Possible asterixis, tremor	Absent
Cognition function		
Orientation	Usually impaired	Occasionally impaired
Attention	Globally impaired	May be disorganized
Concentration	Globally impaired	Impaired
Hallucinations	Visual, visual and auditory	Primarily auditory
Delusions	Transient, poorly organized	Systematized
Speech	Pressured, slow, possibly incoherent	Usually coherent

Causes of Delirium

- D: Drugs** anticholinergics, ETOH
E: Endocrine BS, Na, Ca, Mg, cortisol, etc.
M: Metabolic organ failure, hypoxia, etc.
E: Epilepsy or seizures postictal status
N: Neoplasm especially SIADH, CNS
T: Trauma concussion, surgery
I: Infection any
A: Apoplexy any vascular event MI, PE, CVA

Causes of Delirium – I WATCH DEATH

Infectious	Sepsis, encephalitis, meningitis, syphilis, central nervous system (CNS) abscess
Withdrawal	Alcohol, barbiturates, sedative-hypnotics
Acute metabolic	Acidosis, electrolyte disturbance, hepatic or renal failure, other metabolic disturbances (\uparrow or \downarrow glucose, magnesium, calcium)
Trauma	Head trauma, burns
CNS disease	Hemorrhage, stroke, vasculitis, seizures, tumor
Hypoxia	Acute hypoxia, chronic lung disease, hypotension
Deficiencies	Vitamin B ₁₂ , hypovitaminosis, niacin, thiamine
Environmental	Hypothermia, hyperthermia, endocrinopathies: diabetes, adrenal, thyroid
Acute vascular	Hypertensive emergency, subarachnoid hemorrhage, sagittal vein thrombosis
Toxins/drugs	Medications, street drugs, alcohol, pesticides, industrial poisons (e.g., carbon monoxide, cyanide, solvents)
Heavy metals	Lead, mercury

Medications Associated with Delirium

- Sedatives - hypnotics: Benzodiazepines - toxicity or withdrawal
- Narcotics: Demerol, morphine, transdermal fentanyl
- Anticholinergics
 - Antihistamines, antispasmodics, muscle relaxants,
 - Tricyclic antidepressants eg. Amitriptyline
- Anticonvulsants
- Cardiovascular medication
 - β blocker, antidysrhythmics, antihypertension, Digitalis
- Miscellaneous
 - Lithium
 - Aminophylline
 - cimetidine

Approach to acute delirium

- History:
 - Take a careful history of any new drug **started** or any old drug **stopped** recently
- Physical examination:
 - **Vital sign + SpO₂ + F/S**
 - Assess Hydration Status
 - New localizing Neurological findings
 - Rectal Exam to R/O Impaction
 - Distended Bladder

Approach to acute delirium

- Review medication list
- Measurement of serum levels of medications
 - eg. Digoxin, phenytoin
- ECG to r/o silent MI
- Metabolic work up
 - CBC/DC
 - electrolytes/BUN/Cr/glucose
 - Ca, albumin
 - liver function tests
- r/o infection eg. CXR; U/A, U/C, B/C
- ABG: to r/o pCO₂ \uparrow
- CNS work-up, if indicated: brain CT and lumbar puncture