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British Association of Critical Care Nurses

Moral Courage: Meeting the Challenges of a Contemporary Healthcare System

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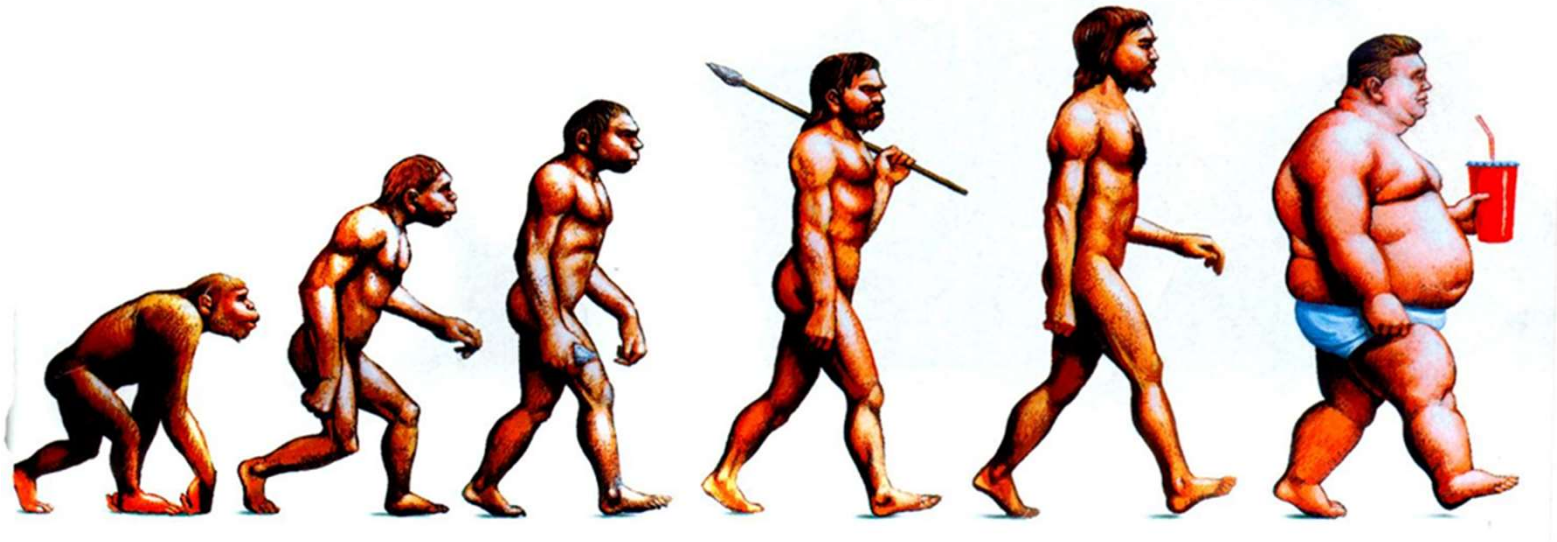
The ABC of Obesity in Critical Care

Dr. Louise Stayt



Aim

- The aim of this workshop is to explore the impact of obesity on airway, breathing and circulation and discuss the clinical implications and management.

Learning Outcomes

- By the end of the session the delegate will be able to:
  - Discuss the extent of obesity in the UK
  - Define and classify obesity
  - Define and discuss Metabolic Syndrome and its pathophysiology
  - Discuss the physiological and clinical implications of obesity on the airway, breathing and cardiovascular system
  - Discuss the clinical management of the obese patient in critical care

Globesity

Obesity is associated with multiple co-morbidities

Global obesity has tripled since 1975

39% of adults are overweight (BMI > 25-29)

13% of adults are obese (BMI >30)

(World Health Organisation 2019)

Definition of Obesity

- “Overweight and obesity are defined as ''abnormal or excessive fat accumulation that presents a risk to health“. (WHO 2019)

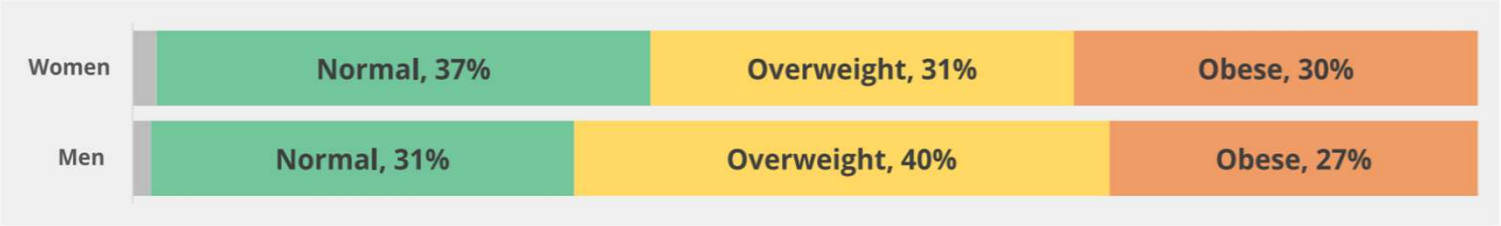
Classification of Obesity

BMI classification	
Underweight	< 18.5
Normal range	18.5 - 24.9
Overweight	⩾ 25.0
Preobese	25.0 - 29.9
Obese	⩾ 30.0
Obese class I	30.0 - 34.9
Obese class II	35.0 - 39.9
Obese class III	⩾ 40.0

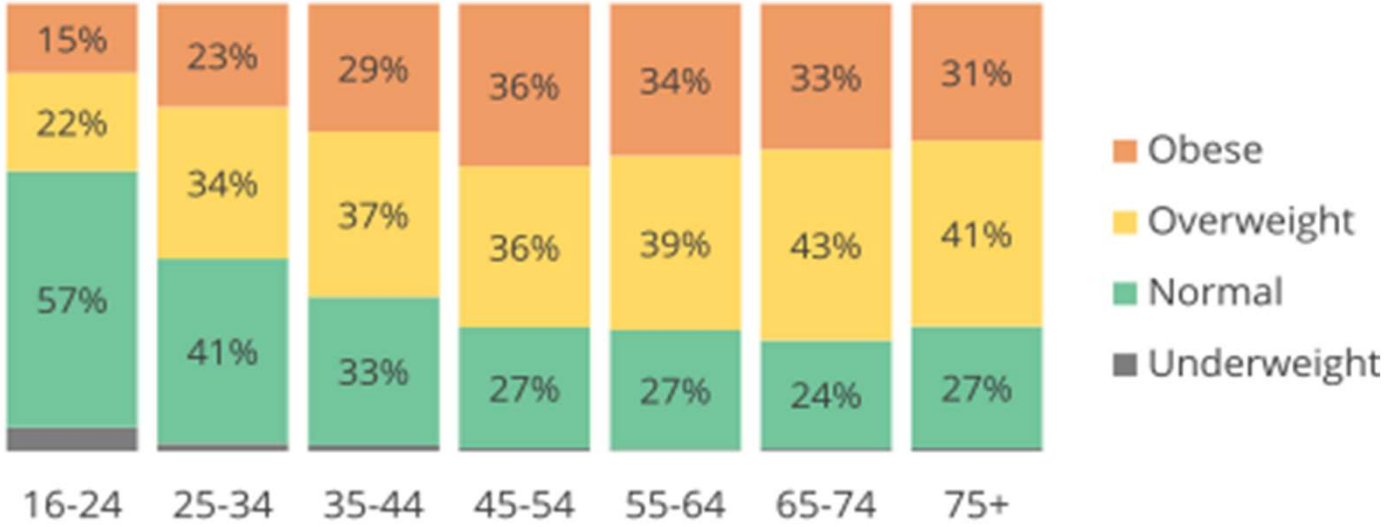
(WHO 2019)

Obesity Statistics UK, 2019

BMI Category by Gender



BMI Category by Age



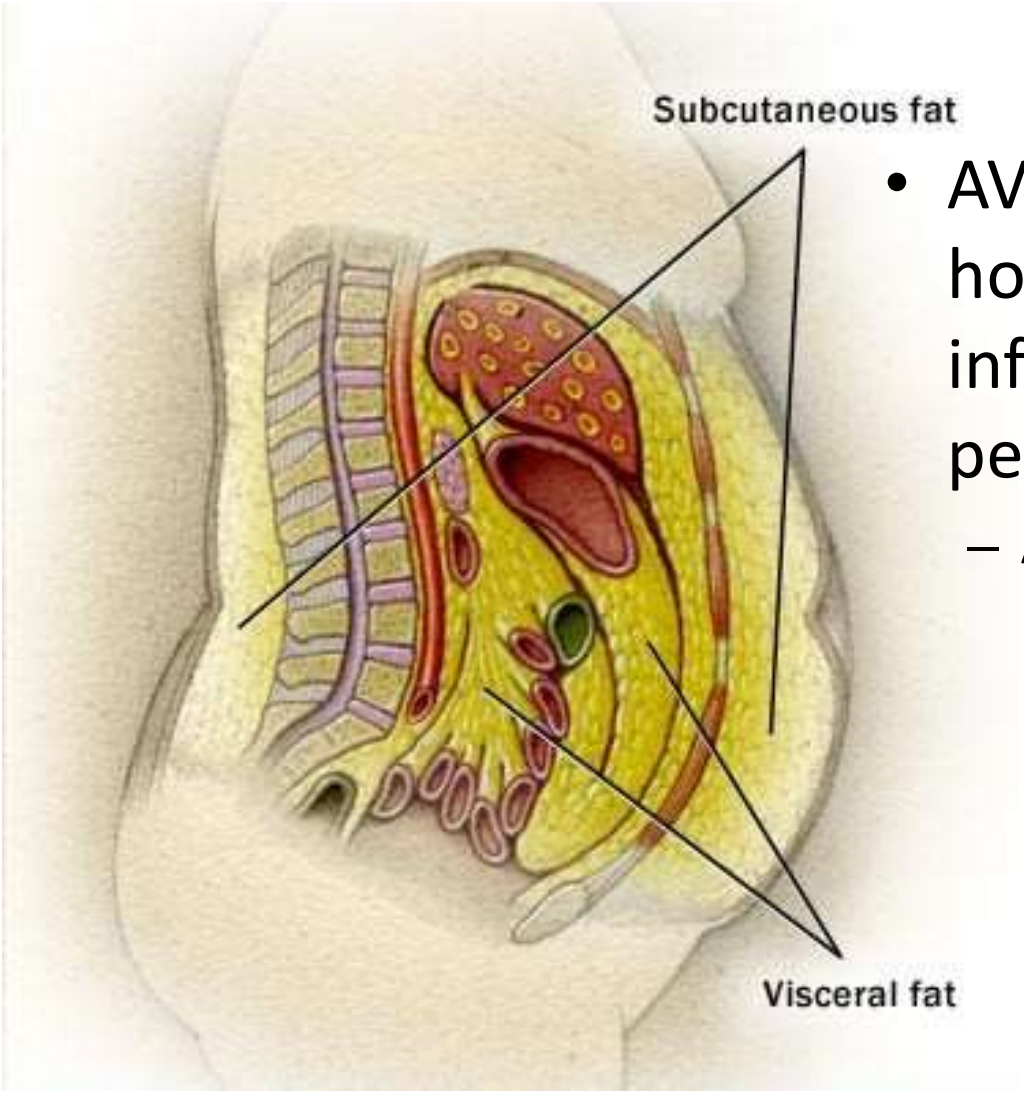
(Commons Library, 2019)

Pathophysiology of Obesity

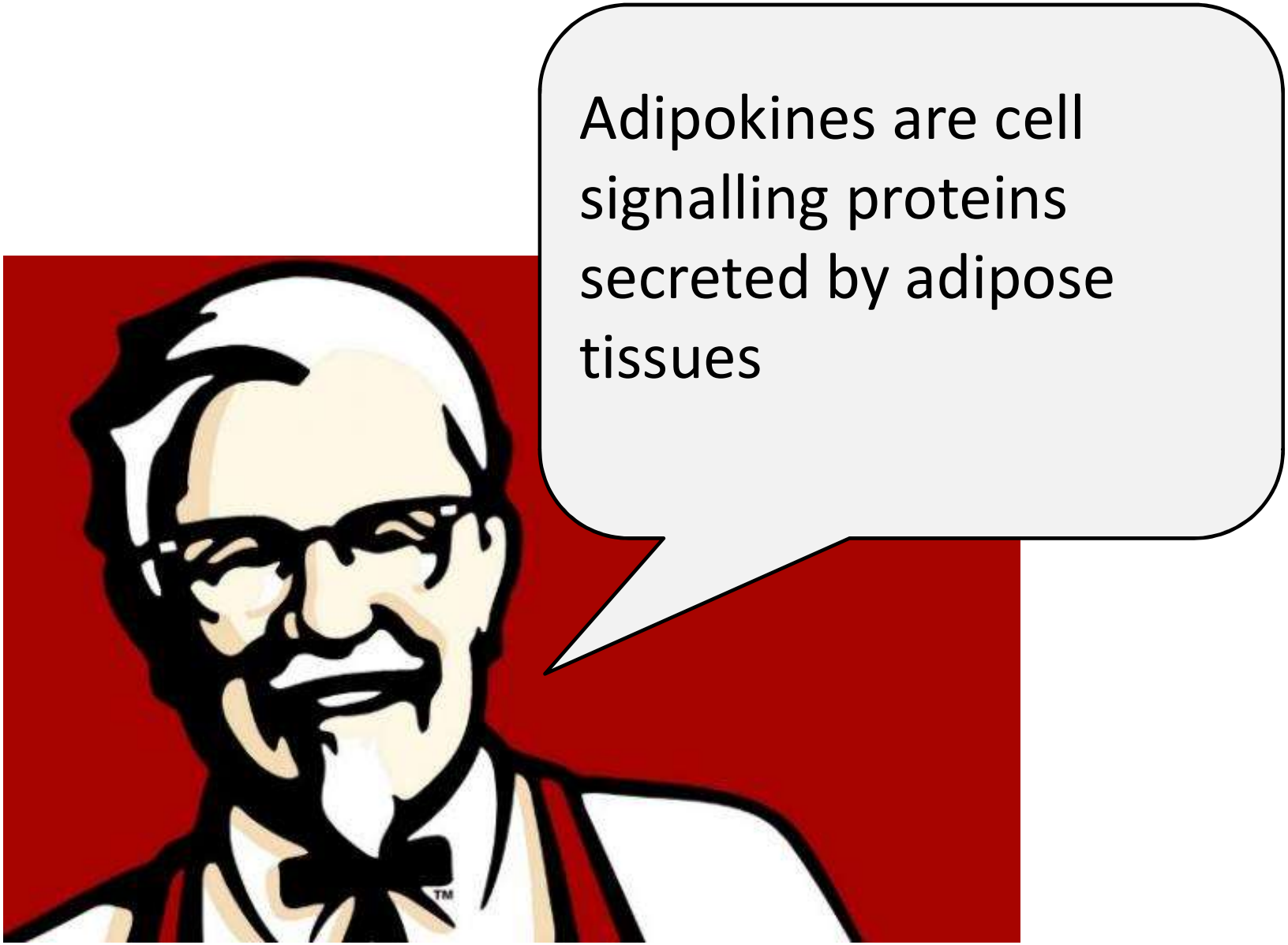
Metabolic Syndrome

- Presence of diabetes mellitus/ impaired glucose tolerance/ insulin resistance
- And two of the following:
  - Hypertension
  - Dyslipidaemia
  - Abdominal Visceral Fat
  - Microalbuminuria

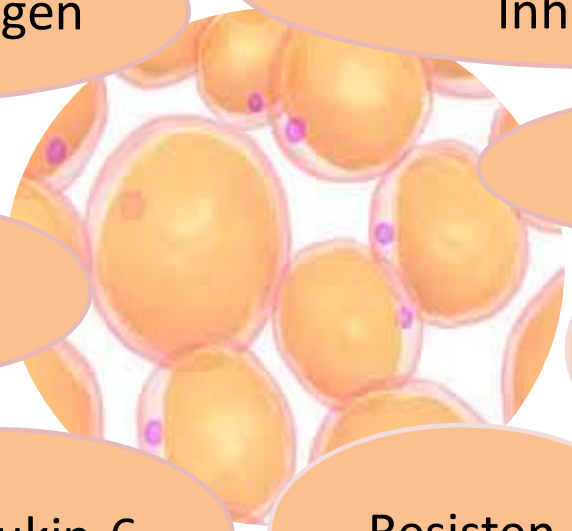
Abdominal Visceral Fat



- AVF secretes hormones and inflammatory peptides:
  - Adipocytokines (Adipokines)


Adipokines are cell signalling proteins secreted by adipose tissues

Adipokines



- Hypertension
- LVH

Angiotensinogen

- Hypercoagulation

Plasminogen Activator Inhibitor-1

- Hypertension
- LVH
- Insulin Resistance

Leptin

Tumour Necrosis Factor α

- Insulin resistance
- Atherosclerosis

Interleukin-6

- Insulin Resistance
- Atherosclerosis

Resisten

Altered Cardiac Contractility

- Cardiomyocyte hypertrophy

Clinical Manifestations

- Hypertension
- Cardiomyopathy- Left Ventricular Hypertrophy
- Atherosclerosis- Increased MI and CHD
- Insulin resistance- Diabetes Mellitus
- Hypercoagulation- Increased VTE

Obesity in Critical Care

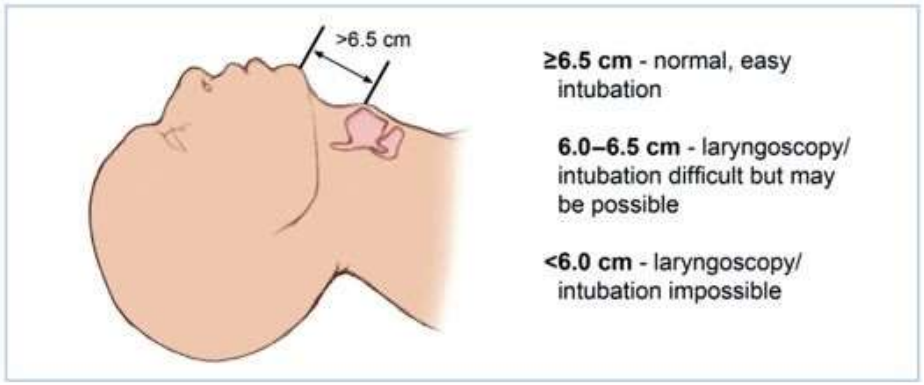
- 26% of patients in critical care are obese (Shashaty *et al.* 2015)
- Controversy over impact of obesity on ICU associated complications and mortality
- Obesity increases risk of respiratory and cardiovascular complications associated with critical illness (Bell *et al.* 2017; Bradley *et al.* 2016)
- Obesity associated with increased mortality but only in the presence of co-morbidity (Abhyankar *et al.* 2012)

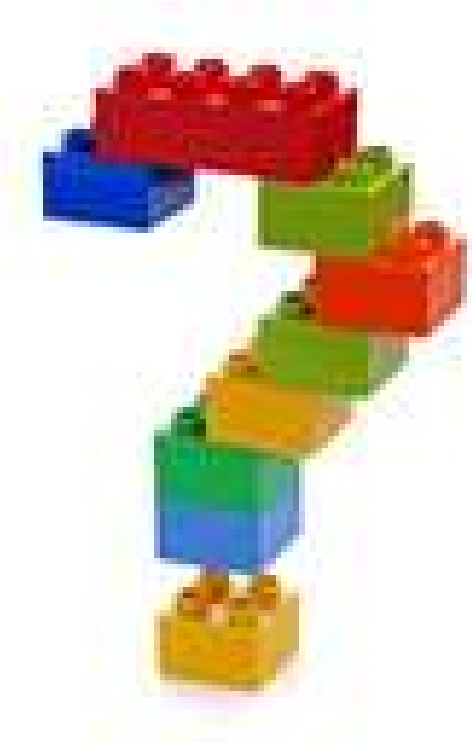
- **Significantly increases nurses work load** (Carrara *et al.* 2015) ☺

Airway: Physiological changes

- Increased facial fat
- Increased parapharangeal fat
- Reduced thyromental distance

(Brusco *et al.* 2015)





- What are the clinical implication of these changes?
- How might we manage them?

Airway: Clinical Implications

- Obstructive Sleep Apnoea
- Compromise mask fit for oxygen and NIV
- Increased grade of intubation (Lundstrom *et al.* 2009; De Jong *et al.* 2015)
- Increased susceptibility to hypoxia (Juvin *et al.* 2003)
- Reduced safe apnoea time (Shashaty *et al.* 2014)

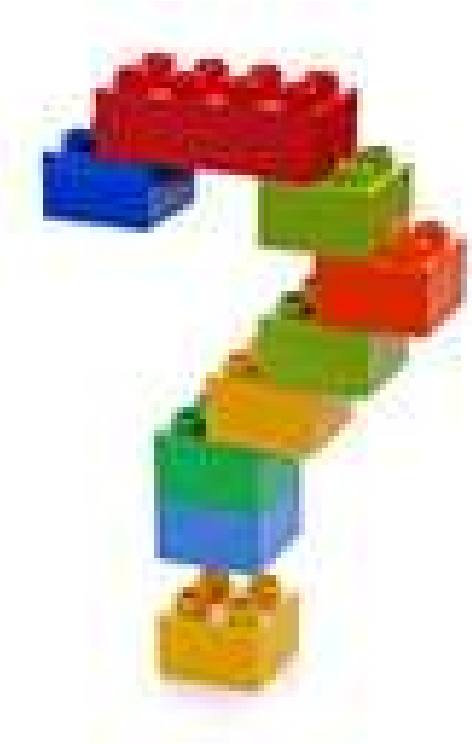
Clinical Management of Airway

- Difficult Airway Risk Assessment
- Pre-oxygenation prior to intubation with CPAP of 10cm H_2O
- 30^o Reverse Trendelenberg
- Fibreoptic at the ready?

(Juvin *et al.* 2003; Simpson *et al.* 2012; Clayton et al 2017)

Breathing: Pathophysiology

- Excess metabolically active adipose tissue
  - Increased CO_2 production
  - Increased O_2 consumption
- Reduced lung compliance
- Diaphragm shift cephalad
- Reduced functional residual capacity (FRC) and expiratory reserve volume (ERV)



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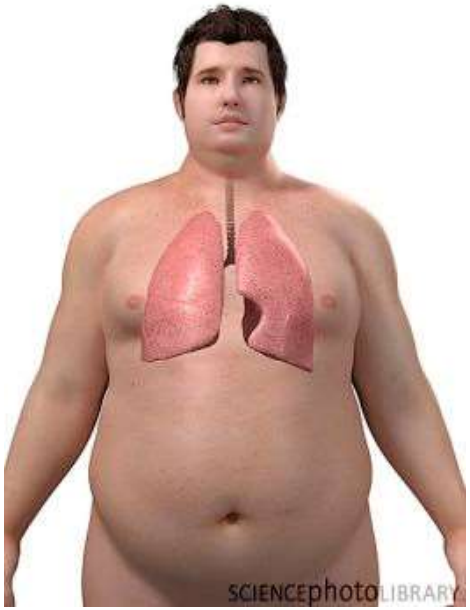
Breathing: Clinical Implications

- ↑Work of breathing
- ↑ Closing capacity
- ↑ Atelectasis
- ↑ Risk of ventilator induced injury
- ↑ Risk of ARDS
- ↓Respiratory muscle endurance
- Hypercarbia
- Bronchoconstriction- expiratory flow limitation
- Obesity Hypoventilation Syndrome
- Obstructive Sleep Apnoea
- (Brusco *et al.* 2015; Shashaty *et al.* 2014: Lederer *et al.* 2011)

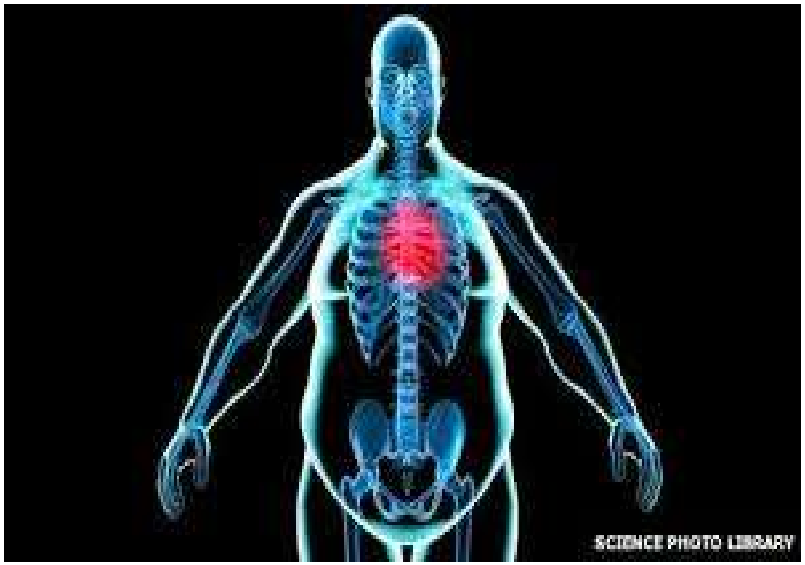


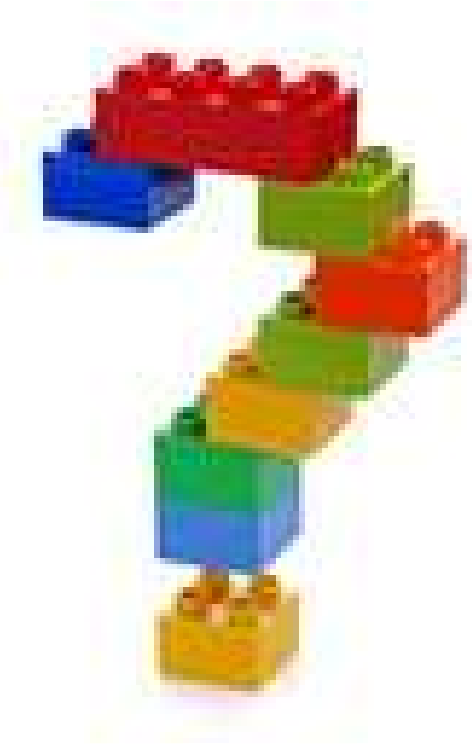
Clinical Management of Breathing

- No evidence based consensus of optimal mechanical ventilation strategy
- Careful consideration of V_T and PEEP in mechanical ventilation (Pfeilsticker et al. 2017; Koutsoukou *et al.* 2004)
- Apply recruitment manoeuvres (Clayton *et al.* 2017)

Cardiovascular: Pathophysiology

- Neovascularisation
- ↑blood volume
- ↑CO (↑ stroke volume)
- LV hypertrophy
- Right sided failure
- ECG abnormalities
- ↑ Sympathetic activity
- Atherosclerosis





- What are the clinical implication of these changes?
- How might we manage them?

Cardiovascular: Clinical Implications

- Reduced reserve capacity of the cardiovascular system
- Increased instability of cardiovascular system
- Increased risk of cardiovascular events
- Increase risk of VTE
- Increased pulmonary vascular resistance
- Underestimated fluid resuscitation volumes

(Winfield *et al.* 2010; Chahal *et al.* 2012; Brusco *et al.* 2015; Shashaty *et al.* 2014)

Clinical Management of Cardiovascular

- No consensus of fluid management strategy for the obese
- Need to develop fluid resuscitation protocol to account for BMI associated changes in blood volume *(*Winfield *et al.* 2010*)*
- *NICE?*
- *Sepsis guidelines?*
- *VTE prophylaxis*

Obesity Paradox

- Some evidence demonstrates a trend for better survival in overweight/obese patients with critical illness, trauma or undergoing surgery (Pan et al 2017; Kramer 2019; Chowdury et al 2018)

- Hedge our bets?

Thank you!

- Enjoy you Dinner!

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