

SLEEP DISORDERED BREATHING

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Disordered breathing during sleep is recognised as a frequent and serious health problem. Three conditions are associated with sleep disruption:

- Upper airway narrowing and collapsibility is the cause of **obstructive** sleep apnea with sleep disruption and daytime somnolence. For symptomatic patients, treatment with continuous positive airway pressure (CPAP) is very effective.
- Neuromuscular weakness (and, possibly, morbid obesity) leads to nocturnal hypoventilation with hypercapnia and hypoxaemia. Non-invasive ventilation (NIV) [Chapter 11] at night is the treatment of choice.
- **Unobstructed** apneas occur with poor left ventricular function in chronic heart failure, related to nocturnal hyperventilation lowering PaCO₂ below the apneic threshold. CPAP treatment removes the apneas and improves nocturnal oxygenation, but does not improve long-term survival (Bradley et al, 2005a).

Flow limitation: apnea. As the pharynx becomes more collapsible, inspiratory flow limitation increases until closure occurs. If closure has occurred at a PaCO_2 below the apneic threshold, a *central* apnea will occur, lasting until the rhythm re-initiation threshold has been exceeded, followed by an *obstructive* apnea (Figure 10.5). This is called a *mixed* apnea.

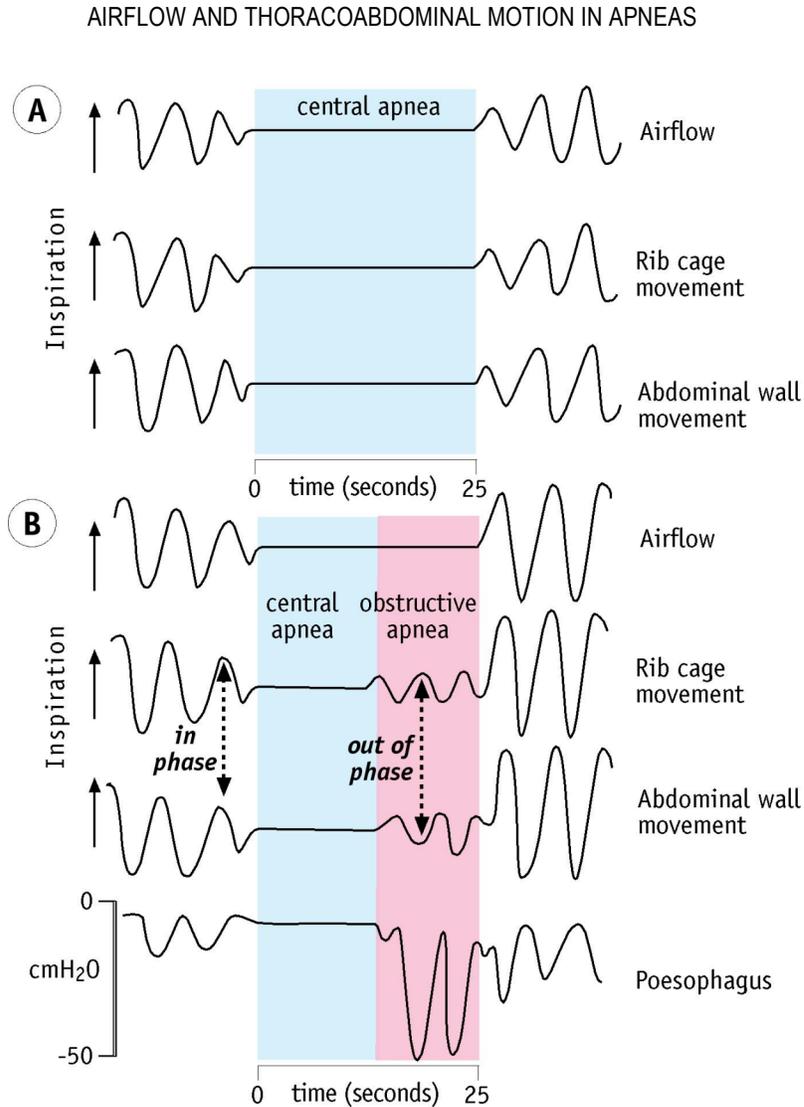


Figure 10.5 Schematic diagram of airflow (from facemask) and anteroposterior movement of the thoracic and abdominal wall [from magnetometers]. Central apneas have no airflow or thoracoabdominal movement. Obstructive apneas have *out of phase* (see arrows) motion of the thorax and abdomen, but no airflow at the mouth. Oesophageal pressure trace is shown for the mixed apnea in B; note larger ΔPoes during obstructed efforts. Modified and redrawn from Gibson, 2009, p. 112.

10.4 Learning Points

- sleep has “quiet” NREM (80% of sleep time) and “active” REM phases; in REM, most muscles (except the diaphragm) are silent
- obstructive sleep apnea (OSA) is caused by a narrow pharynx with increased collapsibility and a negative pharyngeal transmural pressure
- frequent arousals from apneas (when inspiratory effort or hypoxaemia exceeds “threshold”) disrupts sleep and causes daytime somnolence
- obstructive apneas have thoracoabdominal movements (out of phase), falling SaO₂ and zero airflow at the mouth and/or nose
- hypopneas have reduced \dot{V}_I , flow limitation on inspiration (a flow “plateau”) and increased respiratory effort ($\uparrow \Delta P_{oes}$)
- central apneas have no airflow and no respiratory movement
- OSA occurs typically in obese middle-aged men
- nasal CPAP is an effective treatment for OSA
- hypercapnic central apneas respond to nocturnal NIV
- hypocapnic central apneas with periodic breathing occur in CHF when PaCO₂ is < apneic threshold

Further Reading

General

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Historical

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