Chapter 33:

Respiratory Acid–Base Disorders

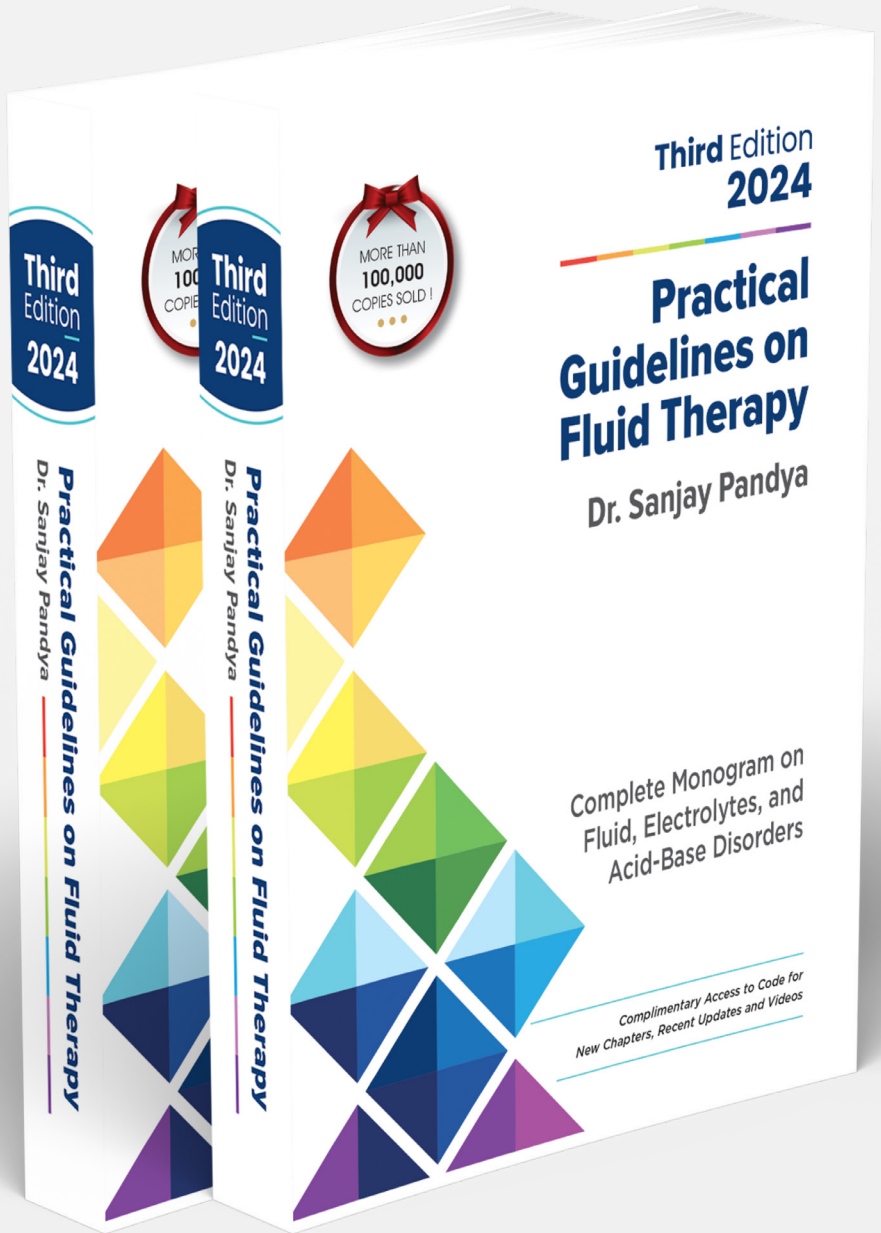

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Table of Contents

33 Respiratory Acid–Base Disorders

Respiratory acidosis and respiratory alkalosis are the two primary respiratory acid-base disorders commonly encountered in clinical practice, both resulting from primary changes in pCO_2 due to various disorders.

RESPIRATORY ACIDOSIS

DEFINITION AND BASIC UNDERSTANDING

Respiratory acidosis, also known as primary hypercapnia, is a clinical disorder characterized by a primary elevation in the $PaCO_2$ (>45 mmHg) leading to a reduction in pH (<7.35) and variable compensatory increase in the plasma HCO_3 concentration.

Respiratory acidosis occurs when the effective alveolar ventilation (CO_2 excretion by the lung) fails to keep pace with the rate of CO_2 production. Acute respiratory acidosis occurs rapidly within <48 hours, while chronic respiratory acidosis develops slowly over days to weeks (>48 hours).

Renal compensation

Respiratory acidosis leads to renal compensation through increased urinary H^+ secretion, resulting in acidic urine. This gradual process leads to a rise in plasma HCO_3 levels, mitigating acidosis. Because renal compensation is a slow process, the compensatory increase in HCO_3 is

small in acute respiratory acidosis. In contrast, in chronic respiratory acidosis, the compensatory rise in HCO_3 is more substantial over time due to robust and prolonged renal compensation.

Acute respiratory acidosis: Every 10 mm of Hg rise in $PaCO_2$ causes 1 mEq/L rise in HCO_3 and 0.1 fall in pH.

Chronic respiratory acidosis: Every 10 mm Hg rise in $PaCO_2$ causes a 4 mEq/L rise in HCO_3 and a 0.03 fall in pH.

Serum HCO_3 usually does not exceed 38 mEq/L due to compensation. If HCO_3 is >38 mEq/L, think of concomitant metabolic alkalosis.

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