DIAGNOSIS OF GENERAL TYPES OF DISTURBANCES

The most common clinical disturbances are simple acid-base disorders; i.e., metabolic acidosis or alkalosis or respiratory acidosis or alkalosis occurring individually. Recognition of simple acid-base disorders requires appreciation of the limits of physiologic compensation for a primary disturbance.

■ SIMPLE ACID-BASE DISORDERS

Primary respiratory disturbances (primary changes in $Paco_2$) invoke compensatory metabolic responses (secondary changes in $[HCO_3^-]$), and primary metabolic disturbances elicit predictable compensatory respiratory responses (secondary changes in $Paco_2$). Physiologic compensation can be predicted from the relationships displayed in **Table 55-1**. In general, with one exception, compensatory responses return the pH toward, but not to, the normal value. Chronic respiratory alkalosis when prolonged is an exception to this rule and may return the pH to a normal value. Metabolic acidosis due to an increase in endogenous acid production (e.g., ketoacidosis or lactic acid acidosis) lowers extracellular fluid $[HCO_3^-]$ and decreases extracellular pH. This stimulates the medullary chemoreceptors to increase ventilation and to return the ratio of $[HCO_3^-]$ to $Paco_2$, and thus pH, toward, but not typically to, the normal value. The degree of respiratory compensation expected in a metabolic acidosis can be predicted from the relationship: $Paco_2 = (1.5 \times [HCO_3^-]) + 8 \pm 2$ (Winter's equation). Thus, applying this equation, a patient with metabolic acidosis and $[HCO_3^-]$ of 12 mmol/L would be expected to have a $Paco_2$ of approximately 26 mmHg. In this example, if values for $Paco_2$ were <24 or >28 mmHg, values that exceed the boundaries for compensation for a simple disorder, a *mixed* disturbance should be recognized (metabolic acidosis plus respiratory alkalosis or metabolic acidosis plus respiratory acidosis, respectively). Compensatory responses for primary metabolic disorders move the