Base Excess and Critical Care in the past and in the future

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The importance of acid-base status on the treatment of diseases has followed the development in blood gas measurement. In 1908 **L.J.Henderson** published his work on the balance between acid and bases that affect the neutrality of blood. From the law of mass action, he expressed the concept of buffers by an equation included carbon dioxide, carbonic acid, bicarbonate and the constant of dissociation. The pH scale was invented by **S.P.L. Sørensen** in 1909 and in 1917 **K.A.Hasselbalch**, influenced by pH nomenclature, made a logarithmic rearrangement of the Henderson equation, and thereby the well known Henderson-Hasselbalch equation. The equation was written to permit the calculation of pH from the measurable total CO_2. The next step happen 35 years later, during the Polio-epidemic, when **P.Astrup** in 1952, using the Henderson-Hasselbalch equation, introduced the estimation of pCO_2 based on pH measurements at different but known pCO_2. This method made it possible to diagnose respiratory acidosis, and thereby the start of intensive care and ventilatory treatment. In 1958 **J.W.Severingshaus** introduced the CO_2 electrode for direct measurement of pCO_2. With measurement of pH as well as pCO_2 the Henderson-Hasselbalch equation was now used to calculate the concentration of bicarbonate.

Base Excess and the Acid-Base nomogram

Base excess was introduced by **Ole Siggaard-Andersen** for almost 50 years ago. While pH and pCO_2 are directly measured, the metabolic component, defined as Base excess, is calculated from pH and pCO_2 using the Henderson-Hasselbalch equation and the **Van Slyke** equation. By using base excess the acid base status is made simple and clinical useful. A nomogram including pH, pCO_2 and Base Excess (i.e. the Siggaard-Andersen ACID-BASE Chart) illustrates the acid-base status of the arterial blood. The chart shows normal values as well as values to be expected in typical acid-base disturbances, i.e. acute and chronic respiratory acidosis and alkalosis, and acute and chronic non-respiratory (metabolic) acidosis and alkalosis. Today critical care units use point of care blood gas analyzer with graphic decision support i.e. the acid-base chart. The modern blood gas analyzer also includes measurements of several parameters t.ex. Lactate and electrolytes incl. potassium and chloride. This multi parameter measurement may add new entities in acid-base disturbances in the critical care setting, t.ex. “Dilutions-acidosis” observed after infusion of normal saline, but not after ringers lactate.

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