Coagulation is the result of an orchestrated series of reactions of coagulation factors. Its simplest form is depicted by the coagulation cascade, provided on the reverse side of this letter. Factor levels are expressed as a percent of “normal” plasma. No single individual has 100% of each factor. Reference ranges are established by using a large pool of “normal” plasma samples with assumed 100% of each factor. Typically, reference ranges are published as 60-140% of the pooled specimens.

With one exception, factor levels at birth are below normal adult levels and some will be as low as 10%. Factor VIII levels are at normal adult values at birth. Other factor levels increase towards adult values by 6 months of age but may remain slightly lower throughout childhood. Decreased factor levels do not typically cause infants to bleed due to a natural balance between pro- and anti-coagulants.

Single factor deficiencies, most commonly Factors VIII, IX and XI, may be genetic. When the factor level is < 1%, Hemophilia A (Factor VIII) and B (Factor IX) are severe with spontaneous bleeding. With factor levels between 1-5%, bleeding is moderate. At levels > 5% bleeding most commonly occurs with trauma or surgery. Factor XI deficiency presents with variable bleeding which does not correlate well with factor level.

PT and PTT are the most common laboratory tests of coagulation. Common causes of an elevated PT and/or PTT are multiple acquired deficiencies associated with: Coumadin, Vitamin K deficiency, liver dysfunction, or DIC. Heparin and lupus and/or lupus like anticoagulants interfere with the coagulation assay itself, prolonging the PTT and interfering with factor assays. In a child without a bleeding history, the most common cause of an elevated PTT is a non-specific inhibitor associated with a viral illness.

A one year study of factor assays done at CMH showed that a factor level in a patient below 30% will result in an elevated PT or PTT. In the laboratory, under artificial conditions, with all but one factor level held at 100%, the PT or PTT will be elevated when a single factor level is below 17-47%. This variation depends on the factor being studied.

Factor levels may be used to determine the cause of a prolonged PT and/or PTT. Frequently, this begins with ordering a Mixing Study. The patient’s plasma is mixed with an equal volume of “normal” plasma. If the PT/PTT value normalizes (falls within the normal range) a factor deficiency is indicated. Alternatively, especially when the initial PT/PTT elevation is only a few seconds, there may be a mild inhibitor which is simply diluted out. If a more significant inhibitor is present the PT/PTT will remain elevated after mixing.

The most important component of a determination of a bleeding tendency is a good patient and family history.

PTT Prolonged, PT Normal: Deficiencies of factor(s) VIII, IX, XI and/or XII (intrinsic pathway)

PT Prolonged, PTT Normal: Deficiency of factor VII (extrinsic pathway); occasionally mild-moderate deficiencies of factor(s) II, V, X and/or fibrinogen (common pathway)

Both PT and PTT Prolonged: Deficiencies of factor(s) II, V, X and/or fibrinogen (common pathway); multiple deficiencies
CME Series
Sponsored by Department of Pathology & Laboratory Medicine

Date:       Tuesday, July 19, 2005
Time:      Noon – 13:00
Location: Conference Room 2206.10 WT
Speaker:   Tarak Srivastava, MD
Topic:     To Be Announced