

COAGULATION

LABORATORY TESTS: COAGULATION

THROMBIN TIME (TT): if given amount of purified thrombin is added to patients' plasma, how long does it take that thrombin to clot that patients' fibrinogen to fibrin? Prolonged for three reasons:

A decreased quantity or quality of fibrinogen is available

Something is interfering with the polymerization of the nascent fibrin monomers (chiefly fibrin-split products, liver disease).

Something inhibits the purified thrombin is present (namely heparin; FSPs, thrombin inhibitors).

BLEEDING TIME (BT): Best test to examine how platelets interact with endothelium in a wound. However, platelet function screening assay should be considered first for screening platelet function. In the bleeding time, a small standardized cut is made in the forearm with a blood pressure cuff placed at 40 mm Hg and one sees how long it takes to stop bleeding. BT is normal in the classic hemophiliacs or patients on warfarin. It is prolonged in the following:

Quantitative defects - thrombocytopenia

Qualitative defects - inborn errors of platelet metabolism or acquired disorders such as exposure to aspirin or uremia.

Normal bleeding time is 9 minutes or less with levels (NOTE this test is no longer routinely performed at Shands). 15-20 minutes are clinically important.

PLATELET FUNCTION SCREENING ASSAY (PFA)

The new platelet function screening assay (PFA) is to replace the current invasive template bleeding time. This in-vitro assay simulates the process of primary hemostasis by measuring ability of platelets under high shear stress to aggregate and occlude a microscopic aperture in a membrane coated with collagen and either epinephrine or ADP. Recent literature shows that the PFA is a sensitive and accurate test in screening for von Willebrand disease, other thrombocytopathies, and platelet dysfunction due to medications (e.g. aspirin). Specimens with low platelet counts (less than $100 \times 10^9/L$) and/or low hematocrit (less than 25%) may exhibit prolonged results both in-vivo as well as with this test method. The template bleeding time remains available and should be ordered for evaluation of vascular abnormality at rare occasions.

PT AND PTT (EXTRINSIC AND INTRINSIC): These can be prolonged by virtue of deficiency of some factor or an inhibitor to a factor or phospholipid. A 1:1 mixing study should be performed with incubation.

If elevated PTT - 80% no significant bleeding but 20% could have factor decreased (i.e., VIII, IX, von Willebrand disease (prolonged PTT in less than 25% of cases); lupus anticoagulant; factor VIII inhibitor). If PTT and some elevation of PT must also think of (rare) factor X inhibitor and factor V inhibitor/fibrin glue. It is important to remember that with lupus anticoagulant it is mostly a clotting problem, but bleeding can occur if there is an antibody to factor II.

A SCHEMA FOR PREOPERATIVE HEMOSTATIC EVALUATION

LEVEL OF RISK*	SCREENING HISTORY		PROPOSED SURGERY	RECOMMENDED TESTS
MINIMAL	Negative ± prior surgery	AND	Minor	None
LOW	Negative with prior surgery	AND	Major	Platelet count PTT
MODERATE	Possible bleeding disorder	OR	CNS CPB Prostatectomy	Above tests <i>plus</i> BT PT
HIGH	High suspicious or documented bleeding disorder	AND	Major or minor	Above tests plus FVIII, IX, XI levels TT If these negative, pursue diagnosis

*Level of risk is estimated by the product of the risk of bleeding times the clinical consequence of bleeding.

CNS = central nervous system, CPB = cardiopulmonary bypass, PTT = partial thromboplastin time, BT = bleeding time, PT = prothrombin time, TT = thrombin time.

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