PLATELET FUNCTION IN ANIMALS: PHYSIOLOGY AND PATHOPHYSIOLOGY

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SUMMARY

Appropriate number and function of platelets have an essential role in the coagulation processes. While drop in number of platelets (thrombocytopenia) is well-known, relatively less information is available regarding malfunctions (thrombocytopathies) of platelets. Therefore knowledge of physiology and pathophysiology of platelet function and its laboratory evaluation is essential, especially for veterinary clinicians. Platelets take part in creating a primary haemostatic plug in the place of endothel injury firstly via fibrinogen (aggregation), then they release substances from their granules during the platelet phase of the coagulation and provide a surface for circulating coagulation factors by binding to the subendothelial collagen via von Willebrand factor (adhesion). These processes finally make possible to complete the formation of the secondary, fibrin-net provided haemostatic plug. The most frequently studied function of platelets is the aggregation procedure. This is a Ca-dependent, fibrinogen-mediated process, which follows the shape change and the adhesion of platelets to the subendothelium. The main point of the aggregation is binding of the fibrinogen to its receptor (GPIIb-IIIa, fibrinogen receptor) on the surface of the platelets providing a bridge between the neighbouring cells. For the expression of the fibrinogen receptor several stimulating substances or agonists such as thrombin, adenosine diphosphate (ADP), adrenalin or epinephrine (EPI), collagen, platelet activating factor, serotonin, and thromboxane are necessary. Physiological processes of platelet-plug formation might be influenced by several factors. These are hereditary disorders like von Willebrand’s disease or Basset Hound thrombopathy, and acquired diseases (uræmia, diabetes mellitus). Other conditions when some drugs and chemicals (non steroid anti-inflammatory drugs) influence the number and/or function of platelets should also be mentioned. All these conditions can associate with increasing bleeding tendency. In spite of the fact that disorders of the primary haemostasis lead to less substantial bleeding than coagulopathies the pathophysiological background of these conditions should be understood and recognized.

Evaluation of number and function of platelets is done in clinical pathology laboratories. Counting of platelets is part of routine clinical laboratory work but functional testing of thrombocytes is less commonly applied. Bleeding time measurement (BT) is the simplest and the most widely used platelet function test but suffers from several disadvantages (highly operator-dependent, not specific for thrombocytopathies, standardization is difficult). Studying platelet aggregation by special instruments (aggregometers, in particular optical versions) is proven as a far more sensitive way of detecting platelet function abnormalities than BT.
Unfortunately, tests of platelet functions, especially those for evaluation of aggregation, are limited to laboratories equipped with aggregometers. Functional defects can be studied by in vitro aggregation tests with chemical compounds such as ADP, EPI and collagen. Besides sophisticated aggregometers using whole blood or platelet rich plasma validated nearly for most common animal species in dogs a relatively new point-of-care device, PFA-100® analyzer (Dade-Behring) is claimed to be able to fulfill the criteria that are necessary for appropriate evaluation of platelet function. The PFA-100 is sensitive and accurate for the study of both congenital and acquired platelet defects. The method used by the PFA-100 is based on occlusion of the aperture of the device caused by citrated blood pipetted firstly into two collagen-containing cartridges. Besides collagen, the first cartridge also contains ADP and the second one EPI to induce platelet aggregation. The platelet aggregation stimulated by the collagen-ADP or the collagen-EPI cartridges is monitored by the time required (closure time, CT) for full occlusion of an aperture and is expressed in seconds (ADP-CT and EPI-CT, respectively). In the lecture platelet functions and malfunctions will be summarized and experiences of the authors with optical aggregometers and PFA-100 will be presented focusing on dogs where thrombopathies are most common.