REVIEW

Platelet Aggregation and Platelet-Inhibiting Drugs

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ABSTRACT

Platelet function may cause a progression of central gray matter damage after cerebrospinal hemorrhage or trauma because of the thrombotic occlusion of injured vessels or a vasospasm induced by extravasated blood. It has therefore been suggested that antiplatelet drugs could limit the extent of the neurological lesions produced by a spinal trauma.

In view of this possibility, the hemostatic functions of platelets and the mechanism of action of antiplatelet drugs are briefly reviewed.

Index Entries: Platelet aggregation; antiplatelet drugs; spinal cord injury.

INTRODUCTION

Platelets may play a role in many physiopathological events that are not directly connected with their hemostatic and thrombotic properties, such as inflammation, tumor growth and metastasis, atherosclerosis, and allergies. Moreover, platelets provide a useful model for studies on the mechanisms of amine storage, uptake, and metabolism. In this respect, they act very similar to monoaminergic neurons; therefore, they have been studied in several neurologic and psychiatric disorders and in the assessment of the clinical efficacy of centrally acting drugs (deGae-tano and Garattini, 1978; Metz et al., 1983). Thus, the interactions between platelets and the CNS are manifold, but the major role played by
platelets in CNS disease involves their hemostatic and thrombotic properties. Indeed, considerable evidence has been accumulated on the importance of platelets in cerebrovascular thromboembolism, and the efficacy of antiplatelet drugs in its prevention has been proven (The Canadian Cooperative Study Group, 1978).

Platelet function may also be involved in the progression of CNS damage after cerebromeningeal hemorrhage or after trauma, and clinical trials on the protective effect of antiplatelet drugs in these conditions have been performed or planned (Ono et al., 1984). Endothelial alteration and subsequent platelet aggregation, which may progress to complete vascular occlusion, occur during the first 6 h following spinal injury (Goodman et al., 1979). Since the thrombotic occlusion of the injured vessels, as well as vasospasm induced by extravasated blood, may result in central gray matter damage, antiplatelet drugs could be useful in limiting the residual neurological deficit after spinal trauma. I will discuss in this paper only the hemostatic—and hence the thrombotic—function of platelets and the mechanism of action of antiplatelet drugs, with particular reference to the effects of aspirin and dipyridamole (Dip), which are both currently being tested in an ongoing trial on spinal cord injury (Lombardi, 1985).

**PLATELETS, HEMOSTASIS, AND THROMBOSIS**

Although the majority of our knowledge on platelets has risen from studies on their hemostatic properties in the evaluation of patients with bleeding problems, it has long been recognized that thrombosis is nothing else than "hemostasis in the wrong place," so that at present, increasing attention is being given to the hemostatic abnormalities that may contribute to the much more prevalent problems of thrombosis (Schaefer and Handlin, 1979; Nenci et al., 1982).

Platelets normally circulate as flattened disks, but they lose their discoid shape when they adhere and spread over a foreign surface (Fig. 1(a)] or the walls of blood vessels. When the blood vessel is transected, platelets react with subendothelium, collagen, and other tissue components in and around the vessel wall; platelets can also adhere to the basal membrane underlying the endothelium when the effect of trauma is limited to the denudation of the vascular intima from its endothelial lining.

Stimulated platelets undergo important morphological changes—the so-called "shape change"—consisting of an internal structural reorganization, caused mainly by the centralization of platelet organelles, which may finally fuse into one another when the simulation is strong enough (Frojmovic and Milton, 1982), and of the extension of multiple pseudopodia, which are evident in Fig. 1(b). This shape change, together with the internal transformation, is the consequence of a contractile activity that precedes and produces the secretion into the surrounding medium of

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