The Influence of Physical Activity, Mental Stress and Injury on the Hemostatic Mechanism

Physical Activity

Platelet Numbers and Function

Platelet Numbers. Short periods of strenuous physical activity have been found by most investigators to increase the numbers of platelets in the peripheral blood (Sarajas et al., 1961; Ikkala et al., 1963; Finkel and Cumming, 1965; Dawson and Ogston, 1969; Bennett, 1972; Warlow and Ogston, 1974; Davis et al., 1976; Freedman et al., 1977). This finding, however, is not universal: no change in the platelet count in response to exercise was reported by Prentice and associates (1972) or by Hyers et al. (1980). Whether the platelet count alters during prolonged exercise is also controversial. Using a semi-quantitative technique for platelet enumeration Isaacs and Gordon (1924/25) noted a rise in platelet numbers in men competing in a marathon race. Mandalaki and colleagues (1980) also examined the effect of running a marathon on the platelet count: in a comparison between different years they found a significant increase in platelets when the race was on a day of extreme heat (25°C), but no change was found in the subjects taking part in the two years when the run was undertaken at temperatures of 15 to 18°C. This study demonstrates the possible importance of exogenous factors in the response of the platelet count to exercise and points to the need for considerable additional stress in prolonged exercise to induce a rise in the number of circulating platelets. Neither a 9.6 km-walk in 90 minutes (Bennett, 1972) nor a 10-mile march in 90 minutes (Sarajas et al., 1961) resulted in an increase in the platelet count, and a prolonged walk of 50 miles over 20 hours did not alter platelet numbers (Pegrum et al., 1967).

The mechanism of the rise in the platelet count in response to exercise is uncertain. The rapidity of the rise indicates that the platelets must be released from existing stores. The spleen, containing a
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rapidly mobilisable pool of platelets (Aster, 1966), seemed a likely source, but some investigators have found that the rise in the platelet count after exercise occurs in asplenic individuals (Dawson and Ogston, 1969; Freedman et al., 1977).

Platelet Function. Experiments to define the influence of physical activity on platelet function have not provided decisive conclusions. Differing techniques to assess platelet function and varying severity of the exercise may have contributed to the discordant findings. In the studies of Ikkala et al. (1966), Bennett (1972) and Warlow and Ogston (1974) short periods of strenuous exercise produced no alteration in platelet adhesiveness. In contrast, Prentice and co-workers (1972) and Davis and associates (1976) found increased platelet retention on glass bead columns after exercise. Finkel and Cumming (1965) observed increased platelet adhesiveness by a glass wool filter method when the exercise was performed at 25°C, but not after exercise at -20°C. The influence of prolonged exercise was examined by Bennett (1972): unlike the finding after short periods of exercise he found reduced platelet adhesiveness. Pegrum and colleagues (1967) also observed reduced adhesiveness after a 50-mile walk using two techniques for the measurement of platelet adhesiveness.

The findings from studies on the influence of physical activity on platelet aggregation have also been inconclusive. The rate of ADP-induced platelet aggregation was reported to be variably increased after exercise by Ikkala and associates (1966), while Poller et al. (1971), using a Chandler tube technique, found an increased rate of irreversible platelet aggregation after exercise. Norepinephrine-induced aggregation, but not ADP-induced aggregation, was noted to be increased after exercise (Harrison et al., 1967): in the same study ‘platelet instability’—clumping activity after incubation—was also found after exercise. Warlow and Ogston (1974) found that there is an increased rate of the second phase of ADP and epinephrine-induced aggregation, 5-hydroxytryptamine-induced aggregation and disaggregation, and collagen-induced aggregation after a 15-minute period of strenuous exertion: they could not confirm the finding of Harrison et al. (1967), however, since the changes in platelet aggregation seen with increasing time interval after venepuncture occurred at the same rate in pre- and post-exercise platelet-rich plasma. Increased aggregation in response to ADP was also noted by Prentice et al. (1972). After a marathon run ADP and