Original Articles

PLATELET ADHESIVENESS IN SPONTANEOUS SUBARACHNOID HEAMORRHAGE: A PRELIMINARY STUDY

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Abstract

A preliminary study of platelet adhesiveness in 24 patients with spontaneous subarachnoid haemorrhage due to rupture of intracranial aneurysm shows normal levels in non fatal cases and abnormally high levels in all 4 patients who died, 3 of cerebral infarction and 1 of recurrent haemorrhage. Enhanced platelet adhesiveness in spontaneous subarachnoid haemorrhage, it is suggested, may be correlated with a poor prognosis. Changes in platelet adhesiveness after operation are also discussed.

Introduction

Since the first descriptions of platelets appeared in literature in 1842, many aspects of this third element of blood have become clearly defined and several fresh concepts of its function have emerged (Deykin 1974). The adhesion aggregation reaction of platelets has attained considerable functional significance (Advances in Blood Coagulation 1969). Platelets adhere to the subendothelial fibres of a traumatised vessel wall and also to foreign surfaces particularly glass (Bounameaux 1959). Platelets also form aggregates in vivo and vitro in the presence of ADP, thrombin, connective tissue suspension and collagen (Baumgartner et al., 1971). These properties of adhesion and aggregation of platelets are integral components of the haemostatic process and are altered in a number of widely varied conditions ranging from haemorrhagic disease to malignancy.

A preliminary study is reported of platelet adhesiveness in spontaneous subarachnoid haemorrhage due to rupture of intracranial aneurysm. The principal aim of the study is to determine the pattern of platelet adhesiveness in the acute phases of non operative and operative management of patients suffering from spontaneous subarachnoid hacmorrhage, and to find any correlation between changes in platelet adhesiveness and the clinical course of the patient. In this study platelet adhesiveness was estimated by a modified Hellem's method.

Material and Methods

Serial estimations of platelet adhesiveness were made in 24 patients suffering from spontaneous subarachnoid haemorrhage (SSAH). Platelet adhesiveness was also estimated in 10 hospital patients on bed rest who were not known to have any condition likely to be associated with abnormality of platelet adhesion. These 10 patients made up the control group and their results were compared with those of 10 patients selected randomly from those on non operative treatment for SSAH.

Of the 24 patients with SSAH, 10 were operated upon to prevent recurrence of haemorrhage and recovered uneventfully. Out of the remaining 14 patients 4 died. In 3 the cause of death was verified at post mortem examination as cerebral infarction secondary to intracranial vessel spasm. Post mortem examination was not permitted in one case but death had occurred soon after an acute episode of clinical deterioration diagnosed as recurrence of subarachnoid haemorrhage which was confirmed at lumbar puncture.

Estimations of platelet adhesiveness were made on samples of whole blood which were collected in 5 ml non-wettable syringes containing isotonic citrate solution (0.11 M solution of trisodium citrate).

At a normal haematocrit 0.5 ml of citrate solution was taken and the sample made up to 5 ml giving a 1/4.95 ratio of citrate solution to plasma in the blood sample. In patients with abnormal haematocrit, the amount of citrate in the syringe before withdrawal of blood sample was adjusted according to the formula $x = \frac{(100-H)}{(95-H)}$ (x=ml of citrate solution, H=haematocrit). This was done to keep the citrate concentration of the plasma fraction of the blood and consequently also the Ca^{++} concentrations constant irrespective of the haematocrit.

The 5 ml syringe was mounted on a mechanical device capable of pushing blood through a glass bead column at a constant rate. The device supplied by Glaxo Laboratories, England, consisted of a 50w, 220v motor with three permanent gears which reduced the speed of rotation to about 20 per minute. The movement was transferred to a long screw on which rode an adoptor for the plunger of the syringe.

The glass bead column consisted of polyvinyl tubing, 8.25 cm in length with an internal diameter of 0.5 cm, filled with 2.5G of glass beads (Reflexperlen type 31/7, Dragon-Werk, Bayruth, Germany) with a diameter of about 0.5 mm held in place by a filter unit of non-wettable fine mesh gauze at each end. The glass beads filled about 6.0 cm of the polyvinyl tubing. The number of beads in each column

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was estimated to be about 7,500 giving a total glass surface area of approximately 6000 mm². Since a fairly large number of beads was employed, the surface area became relatively constant and the error arising from minor differences in diameter of the beads was reduced to a minimum.

The time required by the mechanical device to deliver 1 ml of blood was called the delivery time. The volume in the column not occupied by the glass beads was 1 ml. The time required by a platelet to pass through the column was therefore delivery time x 1 and was called the contact time. The delivery time of the mechanical device was 25±1 seconds. The contact time was therefore 25±1x1=25±1 seconds.

Platelet counts were made before and after blood had passed through the glass bead column. The reduction in platelet count after passage of blood through the column was taken as a measure of platelet adhesiveness and the percentage reduction in platelet count was expressed as per cent adhesiveness.

Results

Reproducibility of the method was tested by multiple estimations of platelet adhesiveness on one specimen each from 4 controls and 4 patients. The ranges and mean levels of percentage adhesiveness are shown in the following Table.

Table: Reproducibility of the Method for Estimation of Platelet adhesiveness is shown by the Range and Mean Values of per cent Platelet adhesiveness on Multiple Estimations.

Subjects	*No. of Estimations*	*Range*	*Mean*
Controls			
1	5	12—23	18
2	5	11—25	18
3	5	12—23	18
4	4	14—25	17
Patients			
1	6	13—32	19
2	7	14—26	18
3	6	13—28	18
4	6	13—20	17

Platelet adhesiveness in patients with SSAH was not found to be significantly different from that in the control group, the mean value being 19.75 with a standard deviation of ±2.8 (Fig. 1). In 10 patients who underwent surgical operations for the prevention of recurrence of SSAH, there was transient rise in platelet adhesiveness lasting for 3 post-operative days (Fig. 2).

Platelet adhesiveness was enhanced in all 4 patients who died (Fig. 3). Three died of cerebral infarction verified at post mortem examination and one died following recurrence of SSAH confirmed clinically at lumbar puncture prior to death.

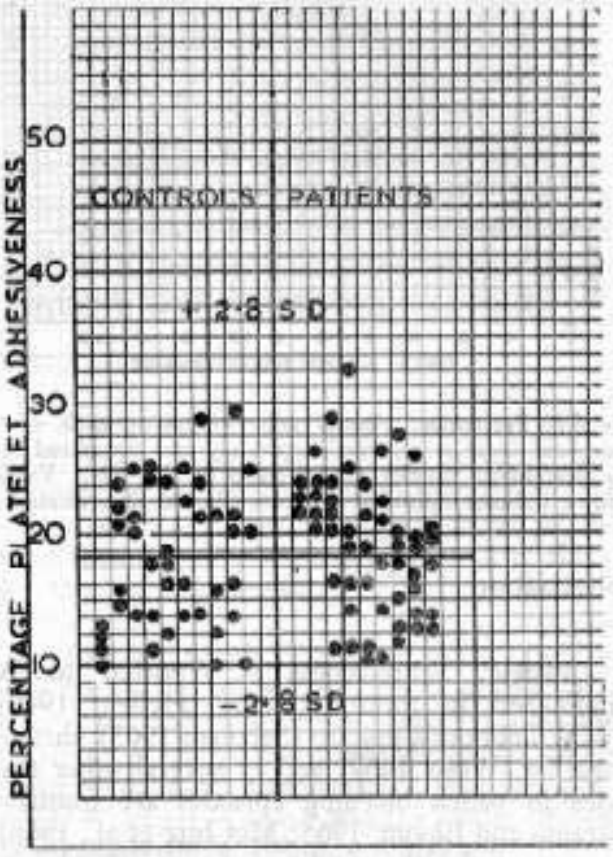

Fig. 1: Platelet adhesiveness in control group.

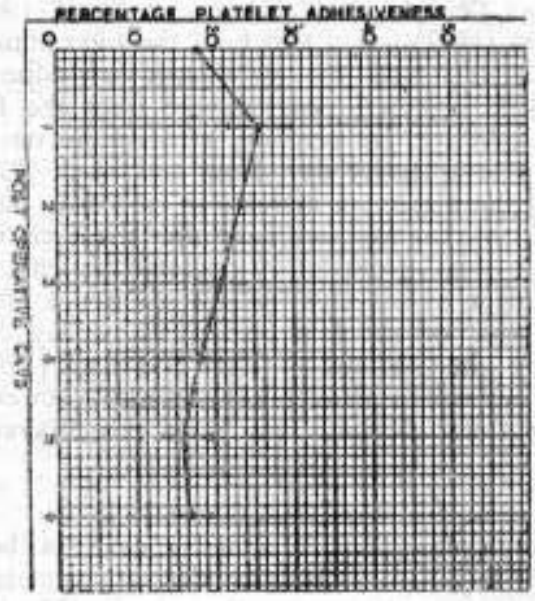

Fig. 2: Platelet adhesiveness in postoperative days.

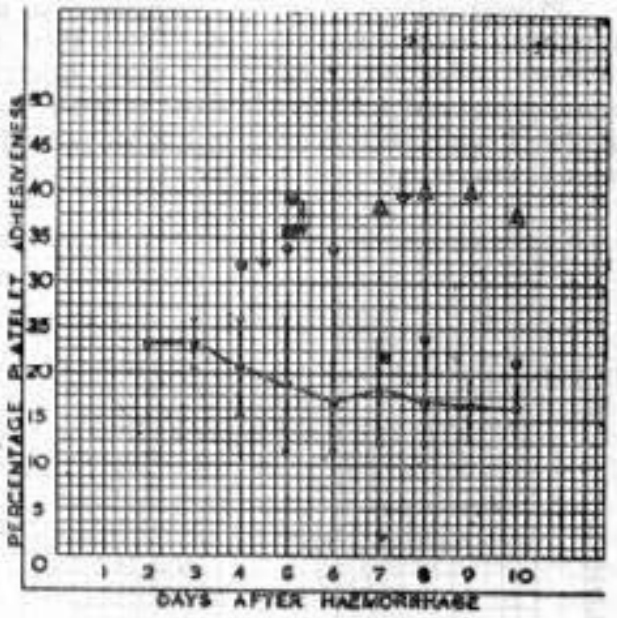

Fig 3: Percentage platelet adhesiveness in each of the four fatal cases is recorded separately and compared with the percentage platelet adhesiveness in the rest. Vertical arrows indicate episodes of acute clinical deterioration.

Discussion

Platelet adhesiveness is reported to be diminished in thrombasthenia (Hellem 1960), von Willebrand's disease (Salzman 1963), thrombopathia (Weiss 1967) and in several other diseases in which bleeding episodes are frequent (Strauss and Bloom, 1965; McClure et al., 1966). In our study the finding of normal platelet adhesiveness in non-fatal cases of spontaneous subarachnoid haemorrhage is consistent with the absence of any known evidence that a coagulation disorder is involved in the etiology of spontaneous aneurysmal rupture.

Increased platelet adhesiveness following surgical procedures has been reported by several authors (Wright, 1942; Ham and Slack, 1967). Wright (1942) found that both the total number of platelets and the percentage of adhesive platelets increased progressively from the first post-operative day reaching a maximum on the 10th post-operative day. Ham and Slack (1967) found the maximum increase in adhesive platelets during the first two days after the operation. In our small group of 10 operated patients the percentage of adhesive platelets showed a maximum rise on the first post-operative day supporting the findings of Ham and Slack (1967). The increase in platelet adhesiveness, however, did not last beyond the third post operative day.

Enhanced platelet adhesiveness has been reported in thromboembolic disease particularly in patients with venous thrombosis (Moolten and Vromen, 1949; Hirsch and McBride, 1965). There are reports also of increased platelet adhesiveness in acute coronary insufficiency and myocardial infarction (Nestel 1961). The finding of an increase in platelet adhesiveness in all the four patients who died, three of cerebral infarction and one of recurrence of haemorrhage, is of interest. Although the number of patients is too small to allow statistically valid conclusions to be drawn, the finding is striking enough to justify its consideration as a sign of poor prognosis in SSAH due to aneurysmal rupture. Further studies, however, are needed to confirm the correlation between increased platelet adhesiveness and cerebral infarction, and to evaluate the full significance of this abnormality of platelet behaviour in spontaneous subarachnoid haemorrhage.

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