Original Article

Platelet Function in Aging

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Abstract

The risk of developing vascular thrombosis, heart diseases and hypertension is strongly associate with aging. These conditions are known to be related with increment of platelet function. The platelet function tests in 138 normal Thai individuals of different age groups were carried out by ADP stimulation technique. There was no statistical significant difference observed in the percent aggregation and time required to reach maximal aggregation. However, the initial aggregation is faster in male and female under 35 years than in the other age groups. There were 2 of 74 females (35-50 years and over 50 years groups) with hyperfunction of platelet observed. The hyperfunction of platelets in these individuals could possibly be one important contributing factor of the pathogenesis of thrombosis in the advanced age.

Key words : Platelet aggregation, aging

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บทคัดย่อ : การทำงานของเกร็ดเลือดกับอายุ

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ผู้สูงอายุมักจะมีโอกาสของการเกิดภาวะหลอดเลือดตีบตัน โรคหัวใจ และความดันโลหิตสูงมากขึ้น ภาวะเหล่านี้มีส่วนเกี่ยวข้องกับการทำงานของเกร็ดเลือด รายงานนี้ เป็นผลการศึกษาหน้าที่ของเกร็ดเลือดโดยใช้ ADP ความเข้มข้น 0.1 และ 0.01 มิลลิโมลาร์ เป็นตัวกระตุ้นเกร็ดเลือดของคนช่วงอายุต่างๆ วัดการเกาะกลุ่มของเกร็ดเลือดโดยอาศัยการเปลี่ยนแปลงของแสงที่ผ่านกลุ่มของเกร็ดเลือด พบว่า ค่าเฉลี่ยของระดับและระยะเวลาการเกิดการเกาะกลุ่มของเกร็ดเลือดสูงสุดในช่วงอายุต่างๆ ไม่มีความแตกต่างกันอย่างมีนัยสำคัญทั้งในเพศชายและเพศหญิงที่อายุต่ำกว่า 35 ปี เกิด initial aggregation เร็วกว่าช่วงอายุอื่น ผู้หญิง 2 จาก 74 คน ในช่วงอายุ 35-50 ปี และมากกว่า 50 ปี มีการทำงานของเกร็ดเลือดเพิ่มขึ้น ซึ่งอาจเป็นปัจจัยที่ทำให้เกิดภาวะหลอดเลือดอุดตันเมื่อสูงอายุได้

คำหัส : การจับกลุ่มของเกร็ดเลือด, วัยสูงอายุ

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Platelets play specific roles in the hemostatic process that are critically dependent on an adequate number of circulating platelets as well as on normal platelet function. The function of platelets in hemostasis are (1) maintenance of vascular integrity, (2) initial arrest of bleeding by platelet plug formation, and (3) stabilization of the hemostatic plug by contributing to the process of fibrin formation.

Platelets respond in a graded fashion depending on the strength and duration of the stimuli, as well as the physiologic and pathologic states of the platelet. During platelet aggregation, the injured platelet changes its shape from discoid to spherical with pseuopod formation. Initial aggregation of platelets is caused by ADP, which is released from adherent platelets or endothelial cells. A potent initiator of aggregation, ADP causes ambient discoid platelets to transform themselves into reactive spiny spheres. These spheres react with one another to form a mass of aggregated platelets.

According to some reports, only one organ function, such as cardiac, pulmonary, or platelet formation was separately studied. In

various cardiovascular disorder,[1] thrombosis; the platelet reactivity has a significant role, concerning possible aged-related change in platelet reactivity. This study was therefore designed to investigate the possible relation between age and platelet aggregation in healthy males and females of different ages.

Materials and Methods

Specimens : One hundred and thirty eight healthy subjects, 64 males and 74 females, aged 18-77 years, entered this study for platelet aggregation.

Method : Principle of the test is as follow :

Platelet-riched plasma reacted with ADP to form platelet aggregation which was recorded by platelet aggregometer (Automated Aggrecorder II, Diachi, Japan).

Platelet-riched plasma (PRP) and platelet-poor plasma (PPP)

PRP was prepared from citrated blood. The anticoagulated blood was spun at 1,000 rpm at room temperature for 10 minutes and then spun at 3,000 rpm for 10 minutes for PPP as blank.

Platelet count

20 µL of PRP was diluted with 2 mL of 1% ammonium oxalate, and counted in counting chamber under phase contrast microscope.

Platelet aggregation

0.5 mL of PRP (Platelet counts should be 200,000-250,000 cells/cu.mm.) was mixed with 50 µL of ADP (0.1 mM or 0.01 mM) in a cuvette of platelet aggregometer at 37°C for 5 minutes.

Results

The results in percentage for hypofunction and hyperfunction of platelet in different age groups are summarized in Table 1 and Table 2. As it appears in Table 1 there was a constant difference in hypoaggregation response between males and females. At 0.01 mM ADP concentration the hypoaggregation was 67% in females aged lower than 35 years, but 71% in males at age group between 35-50 years.

Table 1 Number (%) of hypofunction of platelet in different age goups.

Groups (years)	Male		Female	
	0.1mM ADP	0.01mM ADP	0.1mM ADP	0.01mM ADP
< 35	2/22 (9)	2/5 (40)	2/20 (10)	2/3 (67)
35 - 50	4/16 (25)	10/14 (71)	2/25 (6)	11/20 (55)
< 50	3/26 (11)	10/21 (48)	3/29 (10)	4/23 (17)

Table 2 Number (%) of hyperfunction of platelet in different age groups.

Groups (years)	Male		Female	
	0.1mM ADP	0.01mM ADP	0.1mM ADP	0.01mM ADP
< 35	-	-	-	-
35 - 50	-	-	-	1/20 (5)
< 50	-	-	-	1/23 (5)

The rate of initial aggregation of age group below 35 years was faster than that of age group 35-50 and over 50 years in males and females groups.

Among the females the hyperfunction platelets tend to be more than males in all age group as shown in Table 2.

In Table 3 the mean percentage of maximum platelet aggregation in different age groups using various ADP concentrations were 80.58 in 26 males and 84.61 in 29 females of age groups above 50 years using 0.1 mM ADP concentration.

Table 3 Mean percentage of maximum platelet aggregation in different group using various ADP concentrations.

Groups (years)	Male		Female	
	0.1mM ADP	0.01mM ADP	0.1mM ADP	0.01mM ADP
< 35	60.05 (22)*	39.60 (5)	86.25 (20)	91.66 (3)
35 - 50	78.86 (16)	43.93 (14)	88.24 (25)	52.40 (20)
< 50	80.58 (26)	56.24 (21)	84.61 (29)	74.36 (23)

* = (n)

The results of mean of slope/degreee of angle of platelet aggregation using 0.1 mM ADP concentration is increased along with age groups as appears in Table 4. Fast aggregation is likely to be found in old age more than in younger age groups.

Table 4 Mean of slope/degree of angle of platelet aggregation in different age groups using various ADP concentrations.

Groups (years)	Male		Female	
	0.1mM ADP	0.01mM ADP	0.1mM ADP	0.01mM ADP
< 35	0.296/15.96	0.611/31.42	0.312/17.33	0.281/15.70
35 - 50	0.380/20.80	0.623/31.92	0.304/16.91	0.478/25.55
< 50	0.599/29.20	0.705/35.18	0.324/17.95	0.364/20.00

Discussion

The present study was designed to investigate possible differences as a primary and secondary aggregation using low concentration of ADP with respect to sex and age. The previous report[2] indicated that the rate of primary aggregation increased as a function of age in both sexes but there was no similar association with age in secondary aggregation. The present study revealed that there were increase aggregation as a function of age in both sexes. It may be depend on the rate of ADP release in dense body of platelet after stimulation with platelet aggregation agents which were different between age groups. In old age, ADP releases possible slowly than in younger ones. In secondary aggregation there is no correlation with age. However, platelet hyperfunction still could be detected in some female cases. We can conclude that our findings confirm the previous observations by the other investigators[2-5] that platelet aggregation reactivity is age-associated. The risk of developing vascular thrombosis should be strongly alert within the old age.

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