

BLOOD VISCOSITY IN BEHÇET'S DISEASE

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SUMMARY: Behçet's disease is the second major cause of vena cava superior syndrome after the malignancies. It is also known that patients with elevated blood viscosity have a higher risk of developing vein thrombosis. Therefore, we decided that investigation of blood viscosities of Behçet's disease patients may provide useful information and shed light upon this situation. 24 Behçet patients (13 men, 11 women) mean age: 32.41 ± 11.57 at complete stage were included in our study. Whole blood viscosity was measured at eight different shear rates ranging from 230 sec^{-1} to 1.15 sec^{-1} . At all these shear rates in whole blood viscosity a significant increase was noted ($P < 0.05$). Plasma viscosity measured at three different shear rates were also higher in Behçet patients. The difference was found significant ($P < 0.05$). The packed cell viscosity was found to be lower in Behçet patients. As compared to the controls a significant increase in yield stress was also detected in Behçet cases. Thus it is demonstrated that the haemorheological changes are closely associated with Behçet's disease.

Key Words: Behçet disease, blood viscosity, clinical haemorheology

INTRODUCTION

Behçet's disease (BD) is the second major cause of vena cava superior syndrome after the malignancies (1). It is reported that elevated blood viscosity is an important risk factor for deep vein thrombosis (2). As thrombus formation is a clinical manifestation of BD, we found it worth analyzing blood viscosities of Behçet patients.

In this study, we have determined the two important factors, namely the viscosity function and yield stress, which determine the rheological behaviour of blood. Thus, we have also carried out the first clinic haemorheological research in Türkiye.

MATERIALS AND METHODS

24 Behçet patients treated at Haematology Unit of Hacettepe University Hospital were included in our research. Patients under diuretics were, not considered for the study. Haemorheological studies were carried out at the Physiology Department of Hacettepe University. Out of 24 patients, 13 were men and 11 were women at age group 18 to 52 years old (32.41 ± 11.57).

The history of patients were obtained and positive findings were determined by physical examination. The laboratory tests of Hb, WBC, Htc, bleeding, coagulation, protrombin (PT), activated partial thromboplastin (aPTT) times and fibrinogen were performed.

Viscosity Studies. Blood viscosity was measured with Well Brookfield micro cone-plate viscometer (LTV model, Brookfield Engineering Laboratories Inc., Stoughton, mass.) that generates eight constant shear rates (3). This instrument was calibrated with standard oils. Ten milliliters of venous blood was drawn into a tube

Table 1: Frequency of symptoms (%).

Symptoms	Number of cases	Frequency
Aphthae	24	100
Genital ulcer	24	100
Eye lesion	6	25
Skin lesion	19	79.16
Joint lesion	10	41.66
Gastrointestinal lesion	3	12.5
Vascular lesion	6	25
Neurological symptoms	6	25
Hypertension	7	29.16

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containing 0.1 ml (100 units) of heparin. Viscosity studies were made on freshly drawn specimens. Tests were performed within an hour after taking the blood samples. Prior to viscosity measurement the blood was warmed to $37.0 \text{ }^\circ\text{C}$ and temperature was kept constant by

water circulation around the test chamber by means of a pump (Hake type F, Berlin VII5). 1.2 ml whole blood, plasma, packed cell samples were used for viscosity measurement (4, 5, 6).

Students' T test was used for statistics.

RESULTS

The results of physical examination of BD patients and the frequency of symptoms is given in Table 1. For diagnosis at least three major or two major and two minor

Figure 1: Comparison of Mean Whole Blood Viscosity.

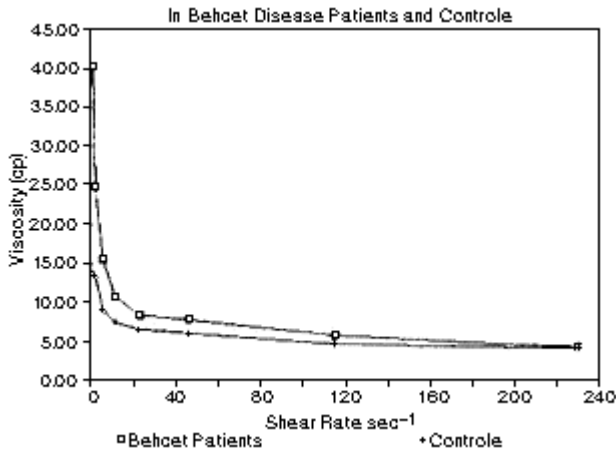


Figure 2: Comparison of Mean Plasma Viscosity.

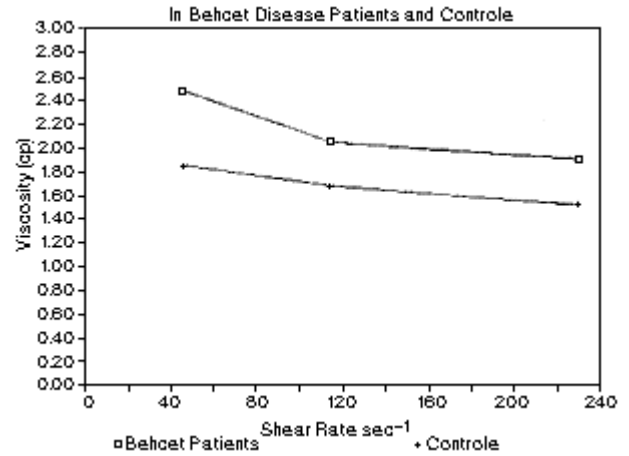


Table 2: Laboratory findings in Behçet cases.

Case	Age	Sex	Hb	WBC	Htc	Bleeding time	Coagulation time	PT	aPTT	Fibrinogen (mg)
1-IT	27	M	9.3	5000	28	4.0'	7.0'	16"	42"	910
2-SF	38	W	14.0	7000	43.5	7.5'	6.5'	13"	40"	600
3-AA	29	W	13.4	7000	40	3.5'	5.5'	10"	27"	920
4-DS	30	W	13.0	6000	40	4.5'	5.0'	13"	35"	550
5-SK	38	W	12.3	6000	30	4.0'	6.0'	13"	35"	910
6-IYP	32	M	10.3	7000	35	5.5'	4.5'	12"	35"	920
7-AT	52	M	12.3	6000	37	1.2'	3.3'	10"	20"	500
8-AA	30	W	12.0	7000	50	6.0'	5.0'	10"	27"	920
9-IB	31	M	13.0	4000	35	3.5'	6.0'	13"	43"	580
10-SG	25	W	12.3	6000	40	5.0'	6.0'	11"	33"	580
11-AYP	23	M	16.1	7200	44	2.0'	3.15'	18"	50"	700
12-BO	33	M	12.0	12000	43	2.3'	3.35'	14"	35"	600
13-TN	18	M	10.9	4000	34	4.0'	5.0	12"	32"	800
14-TT	25	M	14.4	6000	38	6.5'	5.5'	13"	43"	1100
15-SA	30	W	15.4	8200	30	3.5'	7.0'	12"	53"	600
16-RS	49	W	10.4	7000	41	2.5'	5.0'	14"	35"	700
17-CA	48	M	14.9	5000	40	3.5'	3.5'	12"	35"	510
18-HC	28	W	10.9	5000	40	5.5'	6.0'	12"	35"	700
19-YA	27	M	12.0	6000	40	4.0'	6.0'	18"	53"	500
20-AT	30	M	13.0	6500	42	4.2'	6.5'	17"	41"	950
21-OT	47	M	14.0	7000	45	7.3'	7.0'	14"	39"	700
22-HC	30	W	10.0	5000	42	3.5'	5.5'	10"	28"	800
23-NT	20	M	12.0	5500	34	4.3'	4.5'	13"	34"	920
24-AB	30	W	10.90	5000	22	3.9'	3.3'	12"	42"	800

Table 3: Mean values of laboratory findings in Behcet case (n=24).

	Hb	WBC	Htc	Bleeding time	Coagulation time	PT	aPTT	Fibrinogen (mg)
Mean	12.45	6260	38.39	4.23'	5.25'	13.00"	37.16"	740.41
SD	1.76	1610	5.15	1.56'	1.24'	2.32"	8.01"	276.10

Table 4: Mean values of whole blood viscosity in Behcet patients and controls.

Shear rate sec ⁻¹	Behcet patients viscosity (Cp)	Controls viscosity (cp)	T	P
230	4.34 ± 1.57	4.24 ± 1.27	1.69	0.0480
115	5.76 ± 1.05	4.68 ± 1.36	2.23	0.0153
46	7.80 ± 2.21	6.04 ± 1.93	2.93	0.0025
23	8.34 ± 3.50	6.55 ± 2.65	1.98	0.0263
11.5	10.65 ± 5.31	7.46 ± 3.64	2.45	0.0089
5.75	15.58 ± 7.70	8.99 ± 2.82	3.93	0.0001
2.30	24.89 ± 16.12	13.17 ± 5.00	3.40	0.0006
1.15	40.38 ± 23.91 n=24	13.73 ± 6.23 n=24	5.28	0.0000

Table 5: Mean values of plasma viscosity in Behcet patients and controls.

Shear rate sec ⁻¹	Behcet patients viscosity (Cp)	Controls viscosity (cp)	T	P
230	1.90 ± 0.45	1.51 ± 0.46	2.42	0.0102
115	2.04 ± 0.51	1.67 ± 0.60	1.98	0.0277
46	2.48 ± 0.70 n=24	1.85 ± 0.76 n=24	2.52	0.0082

Table 6: Mean values of packed cell viscosity in Behcet patients and controls.

Shear rate sec ⁻¹	Behcet patients viscosity (Cp)	Controls viscosity (cp)	T	P
46	41.53±5.70	45.65 ± 8.51	1.83	0.0374
23	68.40 ± 20.41	75.30 ± 18.33	1.08	0.1413
11.5	97.65 ± 36.58	129.96 ± 44.77	2.49	0.0084
5.75	139.84 ± 46.15	172.88 ± 46.19	2.41	0.0102
2.30	211.92 ± 62.13	260.04 ± 72.48	2.24	0.0153
1.15	326.45 ± 82.26 n=16	383.10 ± 81.63 n=24	2.14	0.0190

symptoms were detected. The history of BD was ranging from 1 to 15 years (mean: 6.3 years).

The results of the laboratory tests are given in Table 2 and the mean values are presented in Table 3. The haematological values are found to be normal except the fibrinogen which was higher in BD. Mean values of

whole blood viscosity in BD and controls are given in Table 4 and shown in Figure 1. At all the shear rates a significant increase in the whole blood viscosity of BD is detected ($P < 0.05$). The plasma viscosity is also found to be elevated in BD ($P < 0.05$), as shown in Table 5, and in Figure 2.

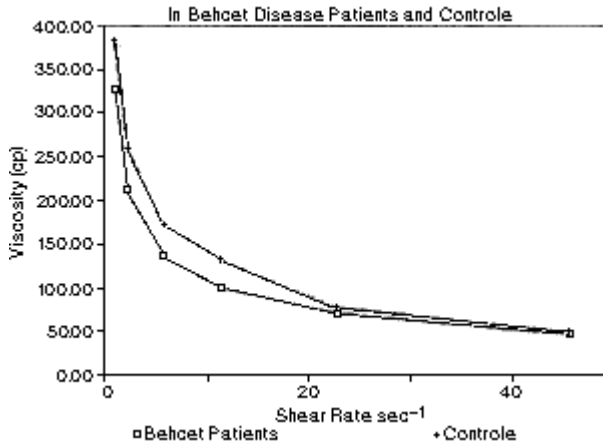


Figure 3: Comparison of Mean Packed Cell Viscosity.

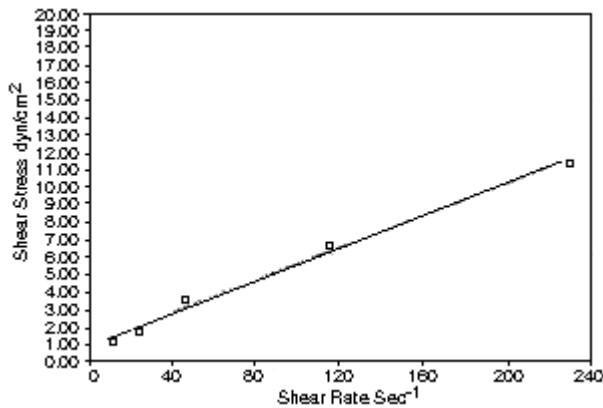


Figure 4: Yield Stress Values in Behcet disease.

Behcet patients dyne/cm ²	Controls dyne/cm ²	T	P
0.13 ± 0.12 n=24	0.04 ± 0.07 n=24	3.8	0.0012

Table 7: Comparison of Mean yield stress in Behcet patient and controls.

Figure 3 and Table 4 shows the packed cell viscosity of BD and controls. The packed cell viscosity is found to be lower in BD. The mean values of yield stress in BD and controls are given in Table 7. As seen in the table yield stress is significantly elevated in BD cases (P<0.05) and Figure 4.

DISCUSSION

Anemia or increase in leukocytes were not observed in the active stage of BD. The hematocrit values and bleeding and coagulation times, PT and aPTT were also

normal. Fibrinogen was higher in BD. This suggests that cellular fraction of blood does not contribute to hemorheological changes in BD. The whole blood and plasma viscosities are found to be elevated in BD whereas the packed cell viscosity is decreased. Thus, it is concluded that the elevated viscosity may be due to the factors of plasma.

Behcet disease is a prethrombotic syndrome and patients are in hypercoagulability state. Studies on hypercoagulability in BD are rather few (7). The results of these studies show that levels of intrinsic and extrinsic coagulation systems are normal (8). There are reports on the increase of fibrin breakdown products which suggest that hypercoagulability is due to a chronic intravascular coagulation (9). As a result of these findings, a defect in vascular intima (vasculitis) is shown to be responsible for hypercoagulability (10). Elevated blood viscosity is major causes of deep vein thrombosis and pulmonary emboli (11). Venous stasis is also responsible for deep vein thrombosis and pulmonary emboli (12). The most susceptible vascular beds to produce thrombosis are large veins of the leg and soleal sinuses. In these regions the shear rate of the blood is decreased due to a relative stasis and the coagulation ensues secondarily (13). We have also found that the increase in whole blood viscosity is greater at lower shear rates.

This study also reveals that in BD the yield stress is significantly elevated Table 7. In view of these results it is concluded that besides vasculitides, blood viscosity and yield stress are important factors which may responsible for thrombosis in Behcet's disease.

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