



DEEP VEIN THROMBOSIS; MEAN PLATELET VOLUME, D-DIMER AND DOPPLER SONOGRAPHY. PATIENTS OF SURGICAL WARDS OF LIAQUAT UNIVERSITY HOSPITAL

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INTRODUCTION

Deep vein thrombosis (DVT) is the formation of a blood clot in a deep vein. According to Virchow's triad, venous thrombosis occurs via three mechanisms: vessel wall damage, sluggish blood flow and increased blood clotting tendency.¹ DVT affects the leg veins commonly; the popliteal vein, femoral vein and deep veins of pelvis are frequently involved.^{2,3} Doppler sonography is a sensitive and specific test for DVT diagnosis, but its results are operator biased. Venography is gold standard test for DVT diagnosis but it is invasive procedure. Sonography is of preferred choice as it is safe, inexpensive and non-invasive.⁴

Recent advances in automated hematology analyzers has revolutionized, as it generates platelet parameters automatically, including mean platelet volume (MPV).⁵ MPV is a machine generated parameter defined as a measure of

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ABSTRACT... Objectives: To study mean platelet volume (MPV) in deep venous thrombosis (DVT) as evaluated by D-Dimmer and Doppler sonography. **Study Design:** Case control study. **Place and Duration:** Department of Surgery, Liaquat University of Medical and Health Sciences Jamshoro/Hyderabad from May 2013 to April 2014. **Subjects and Methods:** A sample of 106 subjects; 50 controls and 53 diagnosed patients of DVT were studied. DVT patients were included according to inclusion and exclusion criteria and after results of Sonography and D-Dimer were available. The Blood samples were collected in bottles containing sodium citrate as anticoagulant. MPV was generated by Sysmex KX 21 hematology analyzer. Informed consent was sought from the volunteer subjects. The Data was analyzed using SPSS version 21.0. Statistically significance was defined at p-value of ≤ 0.05 . **Results:** Mean platelet volume was elevated in deep venous thrombosis patients which were confirmed by clinical examination, sonography and D-Dimer. MPV was elevated in cases; 10.0 ± 0.7 fl compared to controls; 9.55 ± 0.63 fl ($p=0.001$). D-Dimmer was elevated in deep venous thrombosis patients ($p=0.0001$). Age, gender and platelet counts did not revealed any significant differences between cases and controls ($p>0.05$). **Conclusion:** The present study reports elevated MPV in patients suffering from deep venous thrombosis and it is concluded that MPV may be considered as a risk factor for DVT.

Key words: Mean Platelet Volume D-Dimmer Deep venous thrombosis

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platelet size and function. It is reported as part of routing blood count reports, but is mostly overlooked.⁶ MPV is a measure of average size and function of platelets.⁷ Newly bone marrow released platelets are young with large size. They are hyperaggregable because of collagen stickiness. They show more glycoprotein Ib and IIb/IIIa receptors and express large quantities of serotonin, prostaglandins and thromboxane A₂, hence are thrombogenic.⁸ MPV has been reported as a risk factor for atherothrombotic disease activity.⁸⁻¹² MPV is reported as a marker of fibrosis in chronic hepatitis C patients.⁹ MPV is one of the reliable surrogate markers of platelet function, as it reflects inflammatory burden and disease activity in various diseases like ischemic heart diseases, unstable angina, acute pancreatitis, pre-eclampsia,¹⁰⁻¹² pulmonary thromboembolism,¹³ ulcerative colitis, Crohn's disease, and rheumatoid arthritis.¹⁴⁻¹⁶ The platelet activation in

venous and pulmonary thromboembolism as has been reported previously.^{5,16}

The MPV is safe, simple, reliable, and easily generated parameter by hematoanalyzers which may be exploited clinically to predict DVT. To attest the MPV in deep venous thrombosis patients, a case control study was planned to investigate MPV in DVT patients and compare it with controls in our tertiary care hospital.

SUBJECTS AND METHODS

A case control study was conducted at Department of Surgery, Liaquat University Hospital Jamshoro/Hyderabad from May 2013 to April 2014. Patients suspected clinically of DVT, were ordered for Doppler sonography and D-Dimer. A patient was included in study protocol only after DVT was confirmed by clinical, sonography and elevated D-Dimer. Old age subjects suffering from malignancy, diabetes mellitus, anti-platelet agents, lipid lowering agents, anticoagulant therapy, anemia, bleeding tendency and smokers were excluded from study protocol. Study population comprised of; Group I. (Controls) (n=50) normal healthy subjects and Group II. (Cases) (n=53) diagnosed patients of deep venous thrombosis. Sonography was performed by Ultrasound Diagnostic system Model No; SSA-590 A. D-Dimer was measured by immunoassay method. Normal value for normal person was taken at $<0.5 \mu\text{g/ml}$. The Blood samples were collected in bottles containing sodium citrate as anticoagulant for measurement of MPV. Sysmex KX 21 hematology analyzer was used for blood analysis. The research variable was MPV which was to be evaluated and compared between DVT and control groups. The study was conducted according to the *Declaration of Helsinki*. Study was approved by the ethics committee of the institute. Informed consent was taken from the volunteer subjects.

The Data was analyzed using SPSS version 21.0 for Windows release (IBS, incorporation, USA). The data was checked by Shapiro-Wilk tests for normality. The continuous and categorical variables were analyzed using students t-test and

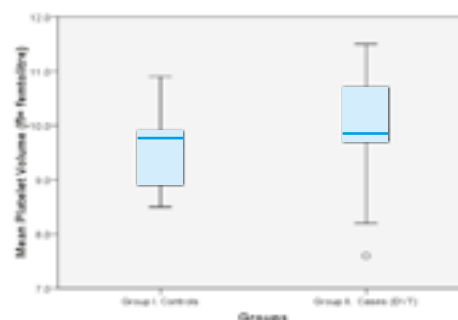
Chi-square tests respectively. The continuous variables were presented as mean \pm S.D, while categorical variables as frequency and percentage. Statistically significance was defined at p-value of ≤ 0.05 .

RESULTS

Mean age of controls and cases was noted as 46.3 ± 7.3 vs. 44.3 ± 7.0 years respectively ($p=0.15$). The age and gender distribution of study population is shown in table-I. Male population predominated in the present study. Platelets revealed no significant difference between controls and cases ($p=0.45$). Mean platelet volume was elevated in diagnosed patients of DVT. MPV was elevated in cases $10.0\pm 0.7\text{fl}$ compared to controls $9.55\pm 0.63\text{fl}$. Statistically significant differences were noted for MPV between groups as indicated by p-value ($p=0.001$). The Box plot shows significant differences in the mean and SD values (Graph-1). D-Dimer was elevated in diagnosed patients of DVT as shown in table I ($p=0.0001$). Briefly, the mean platelet volume was elevated in patients suffering from deep venous thrombosis.

	Group I. Controls (n=50)	Group II. Cases (n=53)	p-value
Age (years)	46.3 ± 7.3	44.3 ± 7.0	0.15
Male	41 (82%)	46 (86.7%)	0.90
Female	09 (18%)	06 (11.3%)	0.06
Platelet counts ($\times 10^3/\mu\text{L}$)	293.3 ± 74.7	283.9 ± 86.6	0.45
Mean Platelet Volume (fl)	9.55 ± 0.63	10.0 ± 0.7	0.001
D-Dimmer ($\mu\text{g/ml}$)	0.42 ± 0.11	7.6 ± 1.3	0.0001

Table-I. Age, Platelet Counts, Mean Platelet Volume and D-Dimmer



Graph-1. Box plot showing mean platelet volume in controls and cases

DISCUSSION

MPV is an indicator of platelet activation, which has an important role in the pathophysiology of thrombosis. Young platelets are larger in size, show more thrombotic potential as they contain large granules rich in vasoactive substances.

Large platelets express more prothrombotic substances, β -thromboglobulin, serotonin, thromboxane A₂. Surface proteins such as P-selectin and glycoprotein IIIa are expressed in large numbers.^{8,17} Increased MPV has been associated with gestational diabetes mellitus,¹⁸ congestive heart failure,¹⁹ essential hypertension,²⁰ hyper-cholesterolemia,²¹ and smoking.²² Hence, these patients were excluded from study protocol to reduce the confounding factors which bias the results.

There is evidence that MPV is largely determined at or before the time of megakaryocyte fragmentation into platelets.²³ On the other hand, several previous studies had reported that the MPV was raised both in arterial and venous thrombosis. MPV predicted a poor clinical outcome in these previous studies. It has been suggested that MPV is a risk factor for thrombosis.^{24,25}

Braekkan et al²⁶ stated that MPV is a risk factor for venous thromboembolism, and increasing MPV is associated with increased risk of total venous thromboembolism in their prospective, population-based study comprising a sample of 25,923 participants.

Acikgoz et al²⁷ reported that the MPV in Behçet's disease. MPV was found elevated and this increase was independent of the disease activity.

Talay et al¹³ studied a sample of 315 consecutive patients comprising 150 diagnosed patients of acute pulmonary thromboembolism and 165 control subjects. MPV in the acute pulmonary thromboembolism group was significantly higher than the controls ($p < 0.0001$). Hence, Talay et al¹³ concluded that the MPV may be a helpful parameter for the diagnosis of acute pulmonary thromboembolism.

Kalkan et al⁵ could find no significant change in MPV and PLT in patients with acute DVT compared to controls. Kalkan et al⁵ study contradicts with present and previous studies.²⁴⁻²⁷ The reason was that the previous study was a retrospective analysis of a data set and that was not able to account for the influence of any residual unmeasured factors that might have affected the MPV.

Our present study has several limitations. First, as it was a case control study of cross sectional design, hence cause effect relationship cannot be ascertained. The elevated MPV was a cause of DVT or a consequence thereof, needs elaboration. Second, the number of our study population is limited. However, validity of study lies in its inclusion and exclusion criteria and comparison with D-Dimer and Doppler sonography and it is the first prospective study conducted at our tertiary care hospital.

CONCLUSION

The present study reports elevated MPV in patients of deep venous thrombosis compared to control. It is concluded that MPV may be considered as a risk factor which may be exploited for better prophylactic management of deep venous thrombosis in surgical patients.

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“Small changes can make a big difference.”

Unknown



AUTHORSHIP AND CONTRIBUTION DECLARATION

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