Platelet indices in the differential diagnosis of thrombocytosis

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ABSTRACT

Objective: To assess the role of platelet indices mainly: Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) for the differential diagnosis of thrombocytosis.

Methods: A prospective case series study conducted at Ibn–Sena Teaching Hospital in Mosul during the period from June 2003 to January 2005. Ninety two patients with thrombocytosis were analyzed for platelets indices using Coulter MS-9. A control group of sixty normal subjects were also included in this study for comparison.

Results: Thrombocytosis was found to be due to two main causes: 12 patients with myeloproliferative disorders, and 80 patients had secondary reactive causes of thrombocytosis. Patients with myeloproliferative disorders had significantly higher Mean Platelet Volume (MPV) than those with reactive thrombocytosis. Also the Platelet Distribution Width (PDW) was higher in patients with myeloproliferative disorders than those with reactive thrombocytosis and control group.

Conclusion: Platelet indices especially PDW seem to be a good variable for the differential diagnosis of thrombocytosis.

Keywords: Thrombocytosis; platelet indices Mean Platelet Volume (MPV); Platelet Distribution Width (PDW).

الخلاصة

أهداف البحث: أجريت هذه الدراسة لمعرفة أهمية البيانات المتعلقة بالأقراص الدموية في الأجهزة المتوفرة في المستشفيات كجهاز كولترام ا س ـ٩ وخاصة الطيف التوزيعي للأقراص ومعدل حجم الأقراص للتشخيص التفريقي في حالات زيادة الأقراص الدموية .

طريقة البحث: دراسة مستقبلية لمجموعة من الحالات. تمت الدراسة في مستشفى ابن سينا التعليمي في الموصل من حزيران ٢٠٠٣ لغاية كانون الثاني ٢٠٠٥. أجريت الدراسة على اثنين وتسعين مريضا مصابون بزيادة تكون الأقراص الدموية من خلال الجهاز الالكتروني كولتر (ام-اس ـ٩) واستحصلت البيانات المتعلقة بالأقراص الدموية وشملت الدراسة ستون شخصا طبيعي لديه عدد طبيعي من الأقراص الدموية للمقارنة .

النتائـــج: وجد أن المرضى المصابون بزيادة (فرط) الأقراص الدموية ينقسمون إلى مجموعتين رئيسيتين، مجموعة مكونة من اثنى عشر مريضا لديهم اعتلال أولي ناجم عن اعتلال نخاعي ومجوعة أخرى تتكون من ثمانين مريضا لديهم أسباب ثانوية (انفعالية) لزيادة الأقراص .

إن المرضى الذين لديهم اعتلال أولي نخاعي كسبب لزيادة الأقراص الدموية فان الطيف التوزيعي للأقراص الدموية وكذلك معدل حجم هذه الأقراص اكبر من أقرانهم ذوي زيادة (فرط) الأقراص الدموية الثانوية أو أقرانهم الأصحاء .

الاستنتاج: إن البيانات المتعلقة بالأقراص الدموية وخاصة الطيف التوزيعي للأقراص يعتبر مؤشرا ومتغيرا جيدا للتشخيص التفريقي في حالات فرط الأقراص الدموية بنوعيه.

Thrombocytosis is the presence of abnormally high number of platelets in the circulating blood. It may result from various physiological stimuli and pathological processes. [1] Thrombocytosis can result from a myeloproliferative disorder, but is more commonly found as reactive phenomenon not caused by a bone marrow diseases but secondary to various pathological states . [2]

Platelet size follows a log –normal distribution and platelet volume heterogeneity has been the subject of considerable investigation, speculation and indeed controversy in recent years. [3]

Platelets from patients with myeloproliferative thrombocytosis may differ from those with reactive thrombocytosis in morphology platelet volume distribution pattern. [4]

The study aims to assess the efficiency of Coulter MS -9 and of the derived variables; Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) for the differential diagnosis of thrombocytosis.

Methods

Ninety two patients with thrombocytosis, i.e. platelets count $>400 \times 10^9$/L, were included in this study, twelve patients with myeloproliferative disorders were studied; the rest were 80 patients with reactive thrombocytosis. A control group of 60 people with mean platelets count of 255×10^9/L with a range (162-388×10^9/L) were included for comparison.

The platelet volume analysis was made using a Coulter counter MS-9; particles with a volume between 2 and 20 FL are classified by this instrument as platelets by definition, a volume distribution histogram is generated and fitted to the nearest log. Normal curve therefrom, the platelet count , MPV and PDW are computed . [5]

PDW is calculated from the volume of 16th and 84th percentile [6]; all measurements were made between one and six hours after the blood had been collected. [7]

Statistical analysis was done using unpaired t test , mean and S.D.

Results

Patients with thrombocytosis were classified according to the cause into primary (myeloproliferative) thrombocytosis (12) patients and secondary (reactive) thrombocytosis (80 patients).

Details of the aetiological classification were summarized in (Table 1)

Table (1): Classification of patients with primary and secondary thrombocytosis

Diagnosis	Total no of cases
1. Primary: No. (12) polycythaemia vera chronic myeloid leukaemia	3 9
2. secondary (reactive) No. (80)	
Infection	25
Non haematological malignancies	23
Iron deficiency anaemia	20
Haemolytic anaemia	6
Post operative including post splenectomy	5
Collagen disease	1

Table (2): Mean values of different platelet variables in normal and patient groups

	No of cases	Mean platelet count (10^9/l)	MPV (fl)	PDW
Normal subjects (control)	60	255	7.2	7.7
Reactive Thrombocytosis	80	537	6.7	7.4
Primary Thrombocytosis	12	625	7.45	8.7

The mean platelets count in the control group was 255×10^9/L with a range (162-388x 10^9/L) in comparison with 537×10^9/L in reactive thrombocytosis, with a range (420-580x10^9/L), while the mean platelet count was 625×10^9/L in primary thrombocytosis with wide range (490-1380x10^9/L).

The Mean Platelet Volume (7.45) in primary thrombocytosis was significantly higher than in reactive thrombocytosis (6.7) ($p<0.01$).

Also the Platelets Distribution Width (PDW) in primary thrombocytosis (8.7) was significantly higher than in reactive thrombocytosis (7.45) (p value<0.01). (Table 2)

Discussion

In patients with primary thrombocytosis there is increased platelet heterogeneity while in secondary (reactive) thrombocytosis this platelets' heterogeneity is only sporadically seen.[8] In patients with primary thrombocytosis there are often abnormalities in platelets' morphology in blood smears including increased percentage of megathrombocytes and giant platelets. By coulter MS-9 counter platelet volume analysis, the percentage of micro-platelets however was also increased; this leads to increase in platelet heterogeneity. [9, 10, 11] This is also true in our study in which PDW in primary thrombocytosis (8.7) was significantly higher than in reactive thrombocytosis (7.4) because of platelet heterogeneity.

The mean platelet count in the control group was 255×10^9/L in comparison with 537×10^9/L in reactive thrombocytosis. The mean platelet count in primary thrombocytosis was 625×10^9/L.

The mean platelet volume (MPV) in patients with primary thrombocytosis was 7.45 fl which was significantly higher than in reactive thrombocytosis 6.7 fl ($p<0.01$) but was not significantly different from control group in which MPV was 7.2 fl.

While regarding the platelets distribution width (PDW) there was no significant difference between normal control group (7.7) and reactive thrombocytosis (7.45) but the PDW in primary thrombocytosis (8.7) was significantly higher than in both control and reactive thrombocytosis ($p<0.01$).

The explanation of the above findings seems that MPV and the percentage of megathrombocytes in patients with myeloproliferative (primary) thrombocytosis were considerably higher than in patients with reactive thrombocytosis [8], so the clinical importance of PDW in this regard seems to be very helpful in the differential diagnosis of thrombocytosis as PDW >9.7 was found in 9 out of 12 patients (75%) with myeloproliferative disorders (primary) in comparison to only 9 out of 80 patients (11%) with reactive thrombocytosis ($p<0.01$).

A high PDW in patients with high platelets count strongly suggests primary thrombocytosis (polycythaemia vera or CML).

Conclusions

Increased platelet heterogeneity through (PDW) estimation (which is increased in value) is found in most patients with myeloproliferative disorders (primary thrombocytosis).

In reactive thrombocytosis platelets heterogeneity is only sporadically seen, so a normal Platelets Distribution Width (PDW) in patients with thrombocytosis (platelets count > 400×10^9/L) strongly suggests reactive thrombocytosis.

References

1. Wintrobe's Clinical hematology, 11th ed, volume 3, 2004:1591.
2. Robbin G, Barnard DL. Thrombocytosis and micro thrombocytosis: a clinical evaluation of 372 cases. Acta haematol 1983; 70:175-82.
3. Hoffbrand A.V., Hutton R A,Laffan M A, et al, (1999) Postgraduate Haematology,4th edition. Oxford, Butterworth-Heinemann Company:556.
4. Murphy S, Thrombocytosis and thrombocytosmia clin. Haematol. 1983:12:89-106.
5. Rowan RM, Fraser C, Gray JH, et al the coulter counter model S plus – the shape of things to come. Clin lab Hamatol 1979; 1:29-40.
6. Giles C. The platelet count and mean platelet volume. Br J Haematol 1981; 48:31-7.

7. Gary SK, Amaros EL, Karparkin S. Use of megathmbocyte as an index of megakaryocyte number: N Engl J Med 1971; 284:11-1.
8. J Van Der Lelie, Aeg K R Von Dem Borne: platelet volume analysis for differential diagnosis of thrombocytosis, J. CL. Path. 1986; 39:129-133.
9. Cortelazzo S, Barhni T Bassan R, et al. A normal aggregation and increased size of platelets in myeloproliferative disorders. Thromb. Hemost. 1980; 43:127-30.
10. Holme S, Simmonds M , Ballek R, et al comparative measurement of platelet size by coulter counter , microscopy of blood seems and high transmission studies . J Lab   clin Med 1981; 97:610-22.
11. Zalla –Z, Scott M, and Frank H. Microscopic platelet size and morphology in various haematologic disorders, blood. 1978; 51 (3):479-485.