Comparison of Manual Versus Automated Platelet Count In Predicting Haemorrhagic Manifestations In Patients With Dengue

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ABSTRACT

Objective: To compare the manual versus automated platelet count in predicting haemorrhagic manifestations in patients with dengue presenting at our hospital in one year.

Study Design: Prospective longitudinal study.

Place and Duration of Study: Pak Emirates Military Hospital, Rawalpindi Pakistan, from Jan 2019 to Jan 2020.

Methodology: This study included 280 cases with confirmed diagnoses of dengue fever. All the patients underwent manual and automated platelet counts within 24 hours of diagnosis confirmation. They were then followed up for 12 weeks to look for haemorrhagic complications. Thrombocytopenia on each method and other socio-demographic factors were compared among the patients with and without haemorrhagic complications.

Results: The mean age of study participants was 36.3±2.75 years. 163(74.1%) were males, while 57(25.9%) were females. 98(44.5%) patients had thrombocytopenia at manual platelet count, while 99(45%) had thrombocytopenia at the automated count. 44(20%) showed the presence of haemorrhagic complication within the 12-week time, while 176(80%) did not manifest any haemorrhagic complication. Pearson chi-square analysis revealed that thrombocytopenia at automated platelet count and advancing age were the factors strongly linked with the presence of haemorrhagic complications among the patients suffering from dengue fever in our setting.

Conclusion: Hemorrhagic complications were common among patients suffering from dengue fever. The results showed that a low platelet count on automated platelet count emerged as a strong predictor for haemorrhagic complications compared to the manual platelet count.

Keywords: Automated platelet count; Blood platelets, Platelet count, Thrombocytopenia, Dengue fever.

INTRODUCTION

Dengue fever is a recent epidemic which occurs each year and hits all the major provinces of our country.[1] This infection is not new or limited to Pakistan; many other parts of the world have faced it for years. Significant mortality and morbidity have been observed among patients suffering from dengue fever in the recent past.[2,3] For years, Various preventive and supportive therapies have been tested to prevent or manage dengue fever. However, each year, thousands of people are still affected, and hundreds of them face life-threatening complications.[4,5]

Dengue fever is usually a clinical diagnosis where physicians in high-risk areas look for various signs and symptoms and then do a blood picture and platelet count to look for complications.[6,7] In recent times, few immunological investigations have been incorporated into the diagnosis of dengue fever. Haemorrhage, being the most lethal and fairly common complication, needs the due attention of the treating physician.[8] Thrombocytopenia has been the usual cause of bleeding among the dengue patients. Various modes have been used to count the platelets of affected individuals.[9] Automated count via analyzer and manual count by the clinician/ technician on a microscope are the two commonly used techniques. Thus, automated platelet counts were highly reliable and accurately predicted clinical bleeding.[10]

As evidenced by the existing literature and clinical experience over the last few years, dengue fever has been a major public health problem, hitting almost all parts of our country and consuming much of the health budget. Despite all the preventive and early diagnostic campaigns, many patients still face complications and require strict monitoring. Haemorrhage, being the most lethal complication,

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needs to be addressed with much care. As platelet count predicts future haemorrhage, it must be accurate enough to guide clinicians. Therefore, we designed this study to compare the manual versus automated platelet count in predicting haemorrhagic manifestations in patients with dengue presenting at our hospital in one year.

METHODOLOGY

The prospective longitudinal study was conducted from January 2019 to January 2020, at the Infectious Diseases/General Medicine Department of Pak Emirates Military Hospital Rawalpindi, Pakistan after IERB approval. The sample size was calculated using the WHO sample size calculator using the population prevalence proportion of thrombocytopenia in dengue fever as 86.5%.[7] Purposive sampling was used to gather samples from medicine, infectious diseases and specialized ward sets for dengue patients.

Inclusion Criteria: Patients aged 18-60 years diagnosed on clinical criteria (documented fever of acute onset+ any one of the typical symptoms of dengue fever like myalgia, arthralgia, rash, headache or pain around the eyes) and routine serological testing, were included.

Exclusion Criteria: Patients labelled as pyrexia of unknown origin or any diagnosed comorbid infection or cause of fever in addition to dengue fever, those who were on steroids or any other medications which could have affected the platelet count or precipitated bleeding, diagnosed cases of bleeding disorders, malignant conditions of the hemato-vascular system, or any other body part were excluded.

All patients had serological testing from the hospital laboratory. All the patients with confirmed dengue fever were based on clinical and laboratory findings by the consultant medical specialist. Patients were admitted and underwent the baseline investigation on day one and one day before discharge. Platelet counts were checked on all the patients by manual and automated methods in our hospital laboratory under the supervision of a consultant pathologist/haematologist. To carry out the platelet counts via automated method, a Sysmex NE-8000 analyzer was used.[11] A standard microscope method was used to count the platelets manually.[12] Laboratory technicians needed to have information that samples were for the study.

Statistical Package for Social Sciences (SPSS) version 26.0 was used for the data analysis. Quantitative variables were expressed as mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

The study included two hundred and twenty patients with a confirmed diagnosis of dengue fever and follow-up at 12 weeks after discharge. Table-I shows that the mean age of study participants was 36.3±2.75 years. 98(44.5%) patients had thrombocytopenia at manual platelet count, while 99(45%) had thrombocytopenia at the automated count. 44(20%) showed the presence of hemorrhagic complication within the 12-week time, while 176(80%) did not manifest any hemorrhagic complication. Table-II shows that thrombocytopenia at automated platelet count and advancing age were the factors strongly linked with the presence of hemorrhagic complications among the patients suffering from dengue fever in our setting (*p*-value <0.05). In contrast, gender and platelet count with the manual method were not significantly associated with hemorrhagic complications (*p*-value> 0.05).

Table-I: Characteristics of Patients included in the Study (n=220)

Age (years) Mean+SD	36.3±2.75 years
Gender	
Male	163(74.1%)
Female	57(25.9%)
Thrombocytopenia on Automated Count	
No	99(45%)
Yes	121(55%)
Thrombocytopenia on Manual Count	
No	98(44.5%)
Yes	122(55.5%)
Presence of Hemorrhagic Complication	
No	176(80%)
Yes	44(20%)
Hemorrhagic Complications faced by the target population	
Petechial hemorrhages	09(4.1%)
Internal hematomas	05(2.3%)
Bleeding from gums	06(2.7%)
Bleeding per rectum	06(2.7%)
Bleeding in vomitingHematuria	05(2.3%)
Prolong bleeding from minor wounds	04(1.8%)
	06(2.7%)
Dengue shock syndrome Others	02 (0.9%)
	02 (0.9%)

Table-II: Relationship of Variables with Presence of Hemorrhagic Complications (n=220)

	No Complicats	Presence of Hemorrhagic Complications	p-value
Age			
40 year or less	86(48.8%)	11(25%)	0.004
>40 years	90(51.2%)	33(75%)	
Gender			
Male	130(73.8%)	33(75%)	0.877
Female	46(26.2%)	11(25%)	
Thrombocytopenia on Manual count			
No	76(43.2%)	22(50%)	0.417
Yes	100(56.8%)	22(50%)	
Thrombocytopenia on Automated Count			
No	87(49.4%)	12(27.3%)	0.007
Yes	89(50.6%)	32(72.7%)	

DISCUSSION

Dengue fever has been hitting Pakistan very badly in the last few years, and we direly need much input from clinicians and researchers to fight this potentially lethal disease. Dengue fever in any form has been linked with a fairly high mortality rate, and morbidity is even higher, posing a great burden on the healthcare budget of a low- and middle-income country like ours.[13,14] Cost-effective and simple means have been tried to predict the life-threatening complications among patients diagnosed with dengue fever. Thrombocytopenia leading to hemorrhagic complications has been a source of concern for all the treating physicians. We planned this study with the intention of comparing the automated platelet count with the automated platelet count in predicting haemorrhagic manifestations in patients with dengue presenting at our hospital in one year.

Tantawichien *et al.* showed that around 24% of the patients with dengue fever and around 54% of those with dengue hemorrhagic fever face complications related to some bleeding.[15] Though we did not categorize the patients regarding the presence of hemorrhagic complications among the dengue fever patients, our results were similar to that study. Lam *et al.* conducted a study to look for the value of daily platelet counts for predicting dengue shock syndrome.[16] They concluded that daily monitoring of platelet counts is important to help identify patients at high risk of dengue shock syndrome. Development of dynamic prediction models that incorporate signs, symptoms, and daily laboratory measurements, could improve dengue shock syndrome prediction and thereby reduce the burden on health services in endemic areas. Pakistan being the endemic area for years now, needs to develop local guidelines in this regard as our study on local population also highlighted the presence of hemorrhagic complications and role of platelet counts in prediction of these complications.

Malok *et al.* conducted a study to compare the two manual methods of platelet counting to find the more accurate one. They concluded that though the alternate platelet count estimation method has been recommended for use, particularly with patients with low haemoglobin values, this study found that the traditional estimation method provided more agreement with automated counts than did the alternate estimation method for all samples as well as for the subset of samples with low haemoglobin values. Currently, the traditional method of estimating platelet counts from blood smears to evaluate automated results provides adequate quality assurance.[17] Webb *et al.* performed a study similar to ours and compared visually counted platelets in a peripheral blood smear with an automated machine platelet count. They concluded that microscopically, an average of 10 high-power fields on a blood film and multiplying by 15,000 gives a platelet count reasonably close to automated machine counts in thousands per microliter.[18] Our study compared the same parameters, but our target population and end points were more specific.

LIMITATIONS OF STUDY

The study design adopted to study the topic does not generate generalizable results. However, ethical reasons compelled us to use this study design due to the non-availability of clear superiority of one method. More data is needed to generalize the results and claim that thrombocytopenia on automated platelet count is a true predictor of bleeding in dengue patients.

CONCLUSION

Hemorrhagic complications were a considerably common finding among the patients suffering from dengue fever. It was evident from the results that low platelet count on automated platelet count emerged as a strong predictor for hemorrhagic complications as compared to the manual platelet count.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

AA & KMU: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

MT & MH: Study design, drafting the manuscript, critical review, approval of the final version to be published.

HZ & MZH: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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