

Correlation of Early Total Leucocyte Count and Red Cell Distribution Width With Outcome in Trauma

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Abstract

Background: Trauma is the leading cause of death in young adults. Risk stratification in patients with trauma remains challenging. There is a need for a readily available prognostic method to categorise these patients.

Aims & Objectives: We aim to measure and correlate red cell distribution width and total leucocyte count in patients presenting with trauma within 24 hours of injury with the outcome.

Methods: We included 52 trauma patients who were admitted in RLJH from November 2019 to April 2020, who did not require emergency surgery and analysed prospectively. Complete blood picture within 24 hours of injury was analysed and outcome measured in terms of length of hospital stay.

Results: There was a statistically significant correlation found between TLC and Length of hospital stay ($p < 0.001$). The correlation between RDW and Length of hospital stay was not statistically significant. The analysis showed that increased hospital stay was associated with high TLC and RDW% done within 24 hours of injury.

Conclusion: TLC and RDW can be used as readily available and simple markers in early prediction of higher morbidity in patients presenting with trauma.

Introduction

Trauma is any physical injury caused by a sudden or brief encounter with various levels of energy. The word 'trauma' comes from a Greek word which means 'wound'. The most common cause of trauma being road traffic accidents.

Trauma is the leading cause of death in children and young adults. Worldwide, it accounts for the death of approximately 1.35 million people per year. The morbidity caused by trauma is also tremendous, leading to non-fatal injuries affecting the quality of life of approximately 20–30 million people around the world each year. Apart from this, the financial burden caused by trauma to countries is alarming accounting to 3% of the annual gross domestic product of the countries.[1] In India, during 2019, a total of 4,37,396 cases of 'Road Accidents' were reported which rendered 4,39,262 persons injured and 1,54,732 deaths as per national crime records bureau (NCRB).[2]

Trauma can lead to morbidity, increased hospital stays, increased expenditure or even death. There is a need for a marker to predict the outcome of a patient early in the course. Despite medical advances, the task of risk stratification in patients with trauma remains challenging. Therefore, there is a need for a readily available method to categorise these patients.

Studies have shown that total leucocyte count and red cell distribution width correlate with severity of injury independently. [3–6] In this study, we aim to correlate both red cell distribution width and total

leucocyte count together with the outcome in terms of length of hospital stay in patients presenting with trauma.

Materials And Methods

We conducted a prospective observational study on 52 patients, who were selected according to inclusion and exclusion criteria and analysed in a level 1 trauma centre in Kolar, Karnataka. Complete blood picture within 24 hours of injury was collected and outcome measured in terms of length of hospital stay.

Inclusion criteria: Trauma patients admitted in RLJH from November 2019 to April 2020.

Exclusion criteria: Patients who require emergency surgery were excluded.

Statistical analysis:

Data was entered into Microsoft excel datasheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Continuous data was represented as mean and standard deviation. **We used ANOVA** test of significance as a test of significance to identify the mean difference between more than two quantitative variables. Correlations were performed with **the Pearson Correlation coefficient**

P-value (Probability that the result is accurate) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyse data.

Results

Total of 52 patients were analysed prospectively, including 88.5% males and 11.5% females. Table 1 shows the distribution of study subjects across various age groups. Majority of the subjects 32.7% were in 21-30yrs age group followed by 23.1% of the subjects in 41-50yrs, 21.2% of the subjects in 31-40yrs, 11.5% of the subjects in 51-60yrs, 5.8% of subjects each in < 20 yrs group and 61-70yrs age group.

Table 1
Distribution of subjects
according to age group.

Age group	N	%
< 20yrs	3	5.8
21-30yrs	17	32.7
31-40yrs	11	21.2
41-50yrs	12	23.1
51-60yrs	6	11.5
61-70yrs	3	5.8
Total	52	100.0

Mode of injury in the study population includes Road traffic accidents (RTA), penetrating stab injuries following alleged assaults. 80.8% of the subjects had RTA and 19.2% of the subjects had Stab.

Descriptive statistics in Table 2 represents total leucocyte count, red cell distribution width and haemoglobin, which are measured at arrival within 24 hrs of injury along with the length of the patient's stay in hospital.

Table 2
Descriptive statistics length of hospital stay,
TLC, RDW, Hemoglobin

	Mean	SD
Length of hospital stay	11	6
TLC	12.9623	5.6121
RDW	13.3	1.2
Haemoglobin	13.0250	2.3911

Table 3
Mean length of hospital stay according to TLC and RDW.

		Length of hospital stay		P-value
		Mean	Standard Deviation	
TLC	< 13	9	5	< 0.001
	≥ 13	14	6	
RDW	< 14	11	6	0.755
	≥ 14	12	5	

The study subjects are divided based on the TLC and RDW values and the length of hospital stay was compared in the groups which are represented in Table.3 TLC ≥ 13 thousand/ mm^3 and RDW $\geq 14\%$ was taken as the cutoff. The mean length of hospital stay in patients with high TLC is significantly higher than in those with low TLC 14 ± 6 days vs 9 ± 5 days; $p < 0.001$. The mean length of hospital stay is slightly higher in patients with high RDW% than those with lo RDW% which is not statistically significant 12 ± 5 days vs 11 ± 6 days; $p = 0.755$.

Correlation of length of hospital stay was analysed for TLC, RDW and haemoglobin values in all the study subjects, which is shown in Table 4. TLC had a positive correlation with the length of hospital stay, which was statistically significant and RDW had a positive correlation with the length of hospital stay, which was not statistically significant. The scatter plots of the correlations are represented in Figs. 1,2 and 3.

Table 4
Correlation of Length of hospital stay with TLC, RDW and Hemoglobin

		Length of hospital stay
TLC	Pearson Correlation	0.441
	P value	< 0.001
RDW	Pearson Correlation	0.070
	P-value	0.621
Haemoglobin	Pearson Correlation	-0.033
	P value	.832

Discussion

Acute-phase response is an inevitable event following trauma, which is mediated by increased levels of inflammatory cytokines, catecholamines and corticosteroids. Post-traumatic leucocytosis is a well-known

phenomenon but the mechanisms of which are controversial. There are various mechanisms described including the release of storage pool of neutrophils from the bone marrow, demargination of leucocytes. RDW represents the range of sizes of red blood cells.

The association of high early TLC and severity of the head injury is well observed.[7] Various studies described controversial results on the association of early TLC and trauma with trauma including abdominal trauma, soft tissue injuries and traumatic brain injury.[3–6] Our institute being a trauma centre, we studied the correlation of early TLC and RDW done within 24 hrs of injury with the morbidity measured in terms of length of hospital stay.

Majercik et al., in their study, found RDW as a useful marker of chronic health status in trauma patients. [8]. The use of RDW as a marker for acute conditions like the trauma is not studied much. In our study, we observed that the patients with high TLC and RDW turned out to stay longer in the hospitals. There is a positive correlation between length of hospital stay and total leucocyte count as well as red cell distribution width. Unlike the common belief that well-nourished patients with high haemoglobin may recover faster, haemoglobin at presentation does not correlate with the length of hospital stay in our study.

There are limitations in the current study worth considering. The baseline pre-trauma RDW values of the patients were not considered as well as the chronic health status. The sample size is too small to analyse the efficacy of these markers as predictors for morbidity. Further major studies are required to analyse the efficacy.

Conclusion

TLC and RDW at presentation can be used as an adjunct in the prediction of higher morbidity along with other significant parameters in trauma patients. Though the correlation of RDW is not statistically significant, it is worth considering planning further studies in this aspect.

Abbreviations

TLC Total Leucocyte Count

RDW Red Cell Distribution Width

Declarations

Ethics approval and consent to participate

Institutional ethical committee clearance was obtained prior to the start of the study. We obtained informed consent forms from all the subjects included.

Consent for publication

Consent was obtained from all the subjects involved in the study for publication of their data.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

There is no conflict of interests among the authors for both financial and nonfinancial,

Funding

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Authors' contributions

BCM contributed to the design of the work, the acquisition of data, analysis, have drafted the work and substantively revised it. SPN contributed to the conception, design of the work, analysis, interpretation of data and substantively revised the manuscript.

All the authors have approved the submitted version (and any substantially modified version that involves the author's contribution to the study); and have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Figures

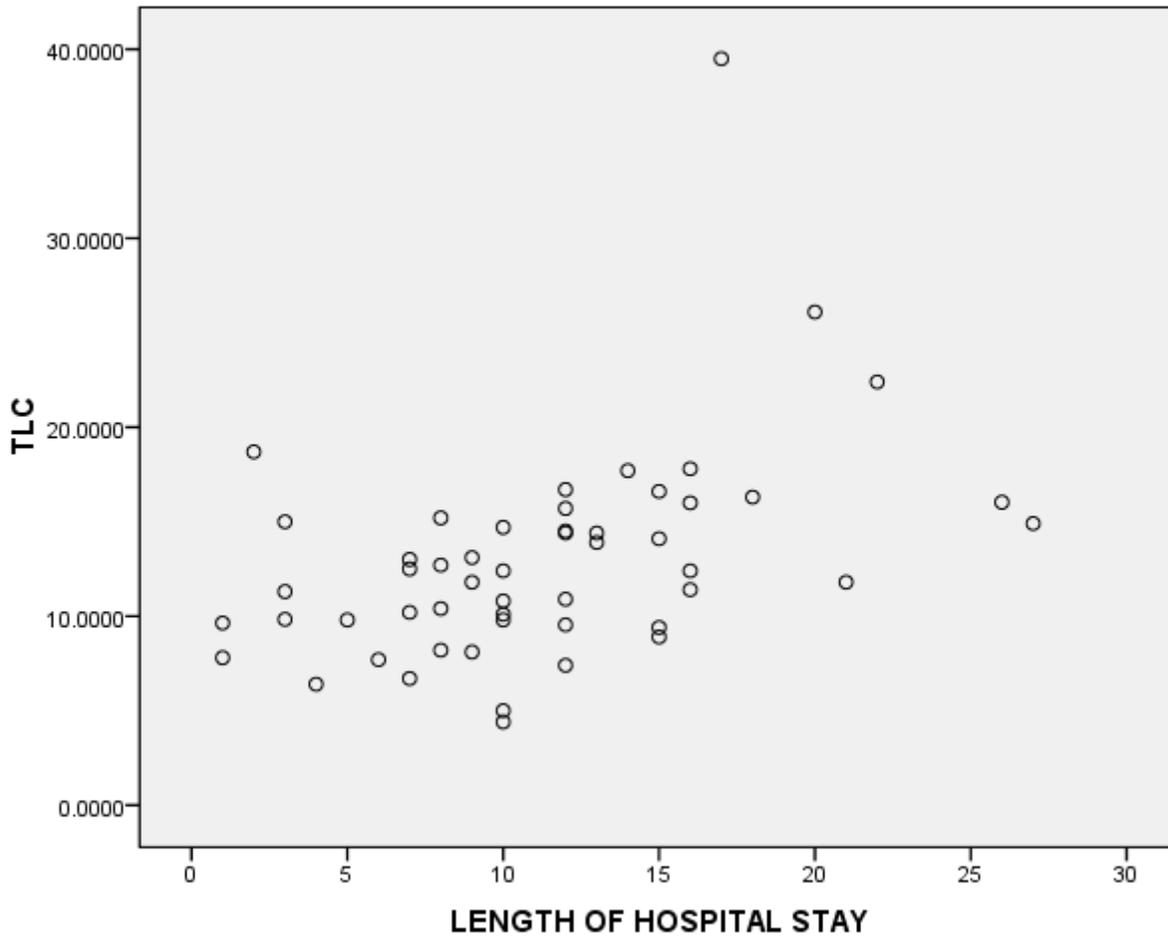


Figure 1

Scatter plot of correlation between length of hospital stay and TLC

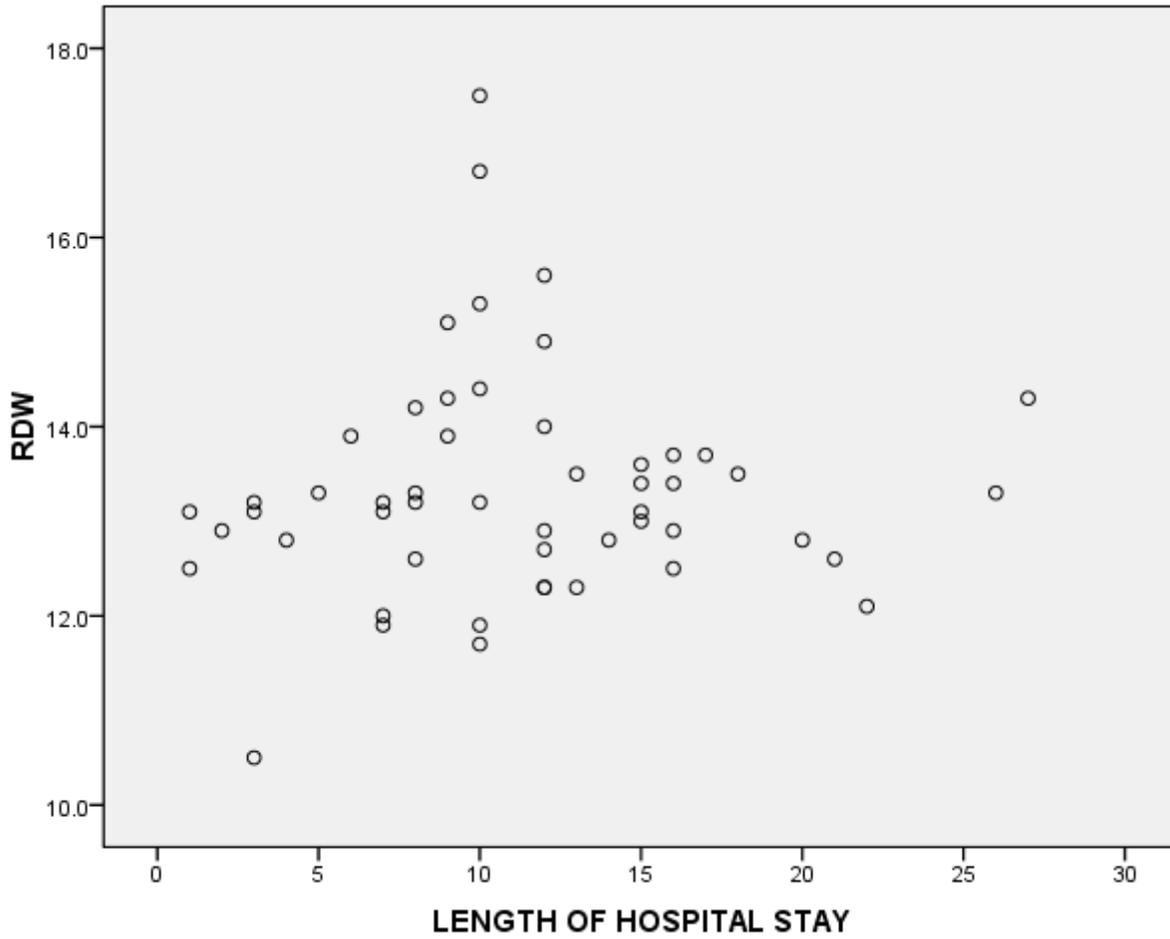


Figure 2

Scatter plot of correlation between length of hospital stay and RDW

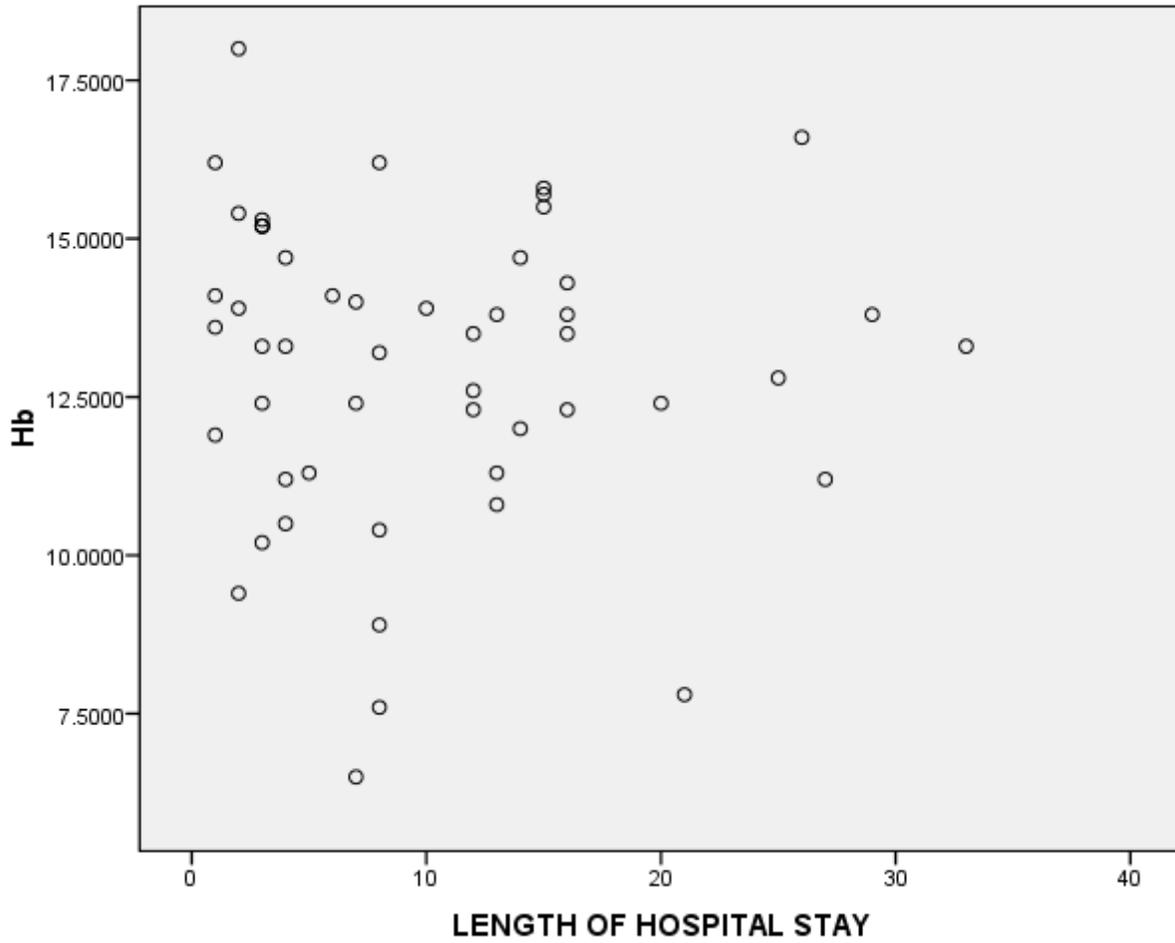


Figure 3

Scatter plot of correlation between length of hospital stay and Hemoglobin