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Study of GCRBS Score: A New Scoring System for Predicting Outcome in Severe Falciparum Malaria at Tertiary Care Centre M.B.G.H. Udaipur

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Abstract: ***Introduction: Severe falciparum malaria is a critical illness resulting in multi-organ dysfunction and death. The purpose of this study is to emphasize GCRBS scoring system for predicting outcome in severe falciparum malaria. Methods: A total of 70 patients of severe falciparum malaria as per WHO criteria 2006 admitted to medicine ward and ICU of R.N.T. Medical College and M.B.G.Hospital Udaipur, Rajasthan from May 2017 to Nov 2017 were taken into the study. On the basis of 5 clinical and biochemical parameter, GCRBS score is calculated for each patient. The GCRBS score has a possible score of 0 to 10. 5 parameters are required for its calculation namely GCS, S.Creatinine, Respiratory rate, S.Bilirubin and Systolic BP (mnemonic GCRBS). Results: The five selected parameters were analysed using the Odds ratio and GCRBS score was calculated for each patient with a possible score from 0-10. With a cut-off score of 5, the GCRBS score predicted mortality with a sensitivity of 84.6% and a specificity of 91.6%. Conclusion: The GCRBS score is easy to calculate and apply. The most important advantage of this scoring system is that all the 5 parameters are to be assessed quantitatively for allotting a score, which would eliminate the possibility of observer bias.***

Keywords: GCRBS Score, Who Criteria 2006

1. Introduction

Malaria has been haunting mankind since evolution. Globally, ~3.2 billion people are at risk of malaria, and 1.2 billion are at high risk. According to World Malaria Report 2018, in 2017, an estimated 219 million cases of malaria occurred worldwide, compared with 239 million cases in 2010 and 217 million cases in 2016.[1]

Most malaria cases in 2017 were in the WHO African Region (200 million or 92%), followed by the WHO South-East Asia Region with 5% of the cases and the WHO Eastern Mediterranean Region with 2%. Fifteen countries in sub-Saharan Africa and India carried almost 80% of the global malaria burden. Five countries accounted for nearly half of all malaria cases worldwide: Nigeria (25%), Democratic Republic of the Congo (11%), Mozambique (5%), India (4%) and Uganda (4%). India reports approximately two-thirds of all confirmed malaria cases in the South-East Asia Region, with five states accounting for 60% of these cases: Orissa, Chhattisgarh, Madhya Pradesh, Jharkhand and West Bengal.However in a recently published article themalaria deaths per year in India has been estimated to be around 205,000 with onlyOrissa accounting for more than 50000 deaths.[2]

WHO enumerates a list of complications for severe falciparum malaria but the importance of each complication has not been assigned.[3,4] For the patients with critical illness various scoring systems have been devised to determine the prognosis. Since severe falciparum malaria is associated with high mortality, a SCORING system for predicting the outcome will be of great help for the treating clinician in identifying patients needing more intensive medical care and to prognosticate the chances of survival.There are numerous severity-of illness scoring systems that have been developed and validated as tools to accurately assess populations of critically ill patients. Currently, the most commonly utilised scoring systems are the APACHE[5] (acute physiology and chronic health evaluation) system, the MPM (mortality probability model), and the SAPS (simplified acute physiology score) system, all designed to predict outcomes in critical illness.

The APACHE II[5] score is difficult to remember, cumbersome to calculate and needs sophisticated laboratory.

The MSA (Malaria Severity Score for Adults)[6] and CSI[7] (Clinical Scoring Index) scores although simple and easy to calculate have subjective variables which would increase the observer bias.

Hence, there has always been a need of a simple, easy to apply score with quantitative variables so that observer bias can be minimised. The present GCRBS[8] score is an attempt in that direction. As seen in the previous studies cerebral malaria and acute renal failure are the major contributors to death. Since the neurological status of a cerebral malaria patient can vary from disoriented to stupor to coma, GCS being an easy to calculate quantitative variable has been used to allot a score for cerebral component. Similarly a respiratory rate of more than 24/min has been used to identify patients having pulmonary edema or ARDS which has a high case fatality rate. But contrary to the previous studies jaundice has been found to be an important predictor of mortality in this study. The GCRBS score has a possible

score of 0 to 10, higher the score poorer the outcome. 5 parameters are required for its calculation namely GCS, S.Creatinine, Respiratory rate, S.Bilirubin and Systolic BP (mnemonic GCRBS)[8]. Out of these only two (Creatinine and bilirubin) are laboratory parameters and the rest three are clinical parameters which can be easily determined at the bedside.

Then a score is allotted to each parameter as shown in Table- 1 and their sum gives the GCRBS score.

Table 1: GCRBS Score[8]

1. GCS	3-6	3
	7-10	1
	11-15	0
2. Creatinine (in mg/dl)	>3	2
	<3	0
3. Respiratory Rate per min.	>24	2
	<24	0
4. Bilirubin (in mg/dl)	>10	2
	<10	0
5. Systolic BP	>90 mmHg	0
	<90 mmHg	1

The most important advantage of this scoring system is that all the 5 parameters are to be assessed quantitatively for allotting a score, which would eliminate the possibility of observer bias.

The aim of our study is to emphasize GCRBS SCORING system for predicting the outcome in case of Severe Falciparum Malaria which will do great help for the treating clinician in identifying patients needing more intensive medical care and to prognosticate the chances of survival.

2. Material and Methods

This study was conducted in the department of medicine R.N.T. Medical College and M.B.G.Hospital Udaipur, Rajasthan a tertiary care hospital catering neighbouring districts of Udaipur and some district from Madhya Pradesh. A total of 70 patients diagnosed to be severe falciparum malaria as per WHO criteria 2006 admitted to medicine ward of R.N.T. Medical College and M.B.G.Hospital Udaipur, Rajasthan from May 2017 to Nov 2017 were taken into the study. Malaria diagnosis was confirmed by Thick or thin smear/ Optimal test/ Immunochromatographic test positive for falciparum malaria. Patient those Known Case of Chronic Kidney Disease, Cirrhosis of Liver Disease, Respiratory Infection, Mental Disorder were excluded from our study.

Table 2: Age and Sex Wise Distribution of Patients

Age	Female		Male		Total	
group (yrs)	No.	Expired	No.	Expired	No.	Expired
10-19	4	1	1	0	5	1
20-29	11	3	15	2	26	5
30-39	4	0	16	3	20	3
40-49	4	1	3	0	7	1
50-59	2	0	3	0	5	0
60-69	0	0	5	1	5	1
70-79	1	1	1	0	2	1
Total	26	6	44	6	70	12

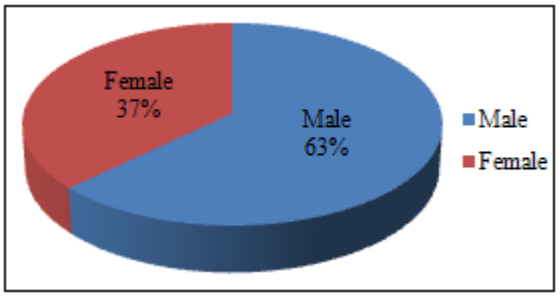


Figure 1: Sex Distribution

A total number of 70 patients were enrolled in our study. Out of 70, 44 were male and 26 were female. Male to Female Ratio is 1.69:1. Of the cases 4 female and 1 male patient were from age group 10-19 year, 11 female amd 15 male patients were from age group 20-29 year, 4 female and 16 male patients were from age group 30-39 year, 4 female and 3 male patients were from age group 40-49 year, 2 female and 3 male patients were from age group 50-59 year, 5 male patients were from age group 60-69 year and 1 male and 1 female patient were from age group 70-79 year.

A detailed clinical evaluation of each patient including history and physical examination was done. Investigations including haemoglobin, DC, TLC, Serum urea, serum creatinine, Liver function test and Arterial blood gas analysis was done for all patients. All the cases were treated with Artesunate (2.4 mg/ kg stat IV followed by 2.4 mg/kg at 12 and 24 h and then daily followed by a full course of an effective ACT (artemisinin-based combinations therapy) and then Primaquine for radical cure. Supportive therapy was given as per standard recommendations on case to case basis. Blood transfusion (whole blood/ packed cell/ fresh blood) was given in patients with Haematocrit< 20% or with bleeding manifestations/ DIC. Mechanical ventilation was provided to patients with pulmonary oedema/ARDS. Inotrope support (Dopamine/ Nor-adrenaline) was given in patients with shock not improving with IV fluids. Patients with renal failure requiring dialysis were given haemodialysis sessions as per need. The clinical parameters associated with anunfavourable outcome were analysed using the Odds ratio. In this study, the Odds ratios express how manytimes a clinical parameter is likely to be found in the death group as compared to the survival group. The computed odds ratios were divided by three to avoid a wide range of score. This is possible because there was no computed odds ratio equivalent to zero. The highest possible score is 10, while the lowest is 0. The higher the score, the poorer the prognosis.

On the basis of 5 clinical and biochemical parameter, GCRBS score is calculated for each patient. The GCRBS score has a possible score of 0 to 10, higher the score poorer the outcome. 5 parameters are required for its calculation namely GCS, S.Creatinine, Respiratory rate, S.Bilirubin and Systolic BP (mnemonic GCRBS). Out of these only two (Creatinine and bilirubin) are laboratory parameters and the rest three are clinical parameters which can be easily determined at the bedside. Then a GCRBS[8] score is calculated to as shown in Table No.1. Of these cerebral malaria (GCS < 11), Renal failure (Creatinine> 3 mg /dl), Respiratory distress (Respiratory rate > 24/min), Jaundice

(Bilirubin > 10 mg/dl) and Shock (Systolic BP < 90 mm of Hg) were significantly associated with death ($p < 0.05$).

3. Results

Table 3: Relation of GCS with Outcome of Patient

GCS	Expired	Discharged	Total
3-6	2	0	2
7-10	8	5	13
11-15	2	53	55
TOTAL	12	58	70

In our study Out of 70 patient, 2 patients present with GCS between 3 to 6 and had expired (100%). Out of 70 patients, 13 patients had GCS between 7 to 10 and out of 13 patient 8 were expired (61.5%) and 5 patients were discharged (38.5%). 55patients presented with GCS between 11 to 15 and out which 2 patients expired (3.63%) and 53 patients were discharged (96.37%).

Table 4: Relation of Serum Creatinine (Mg/dl) with Outcome of Patient

Creatinine (Mg/dl)	Expired	Discharge	Total
≤3	3	54	57
>3	9	4	13
Total	12	58	70

Out of 70 patients, 57 patients present with serum creatinine ≤ 3 mg/dl and 13 patients with serum creatinine> 3 mg/dl. Out of 57 patients who had serum creatinine ≤ 3 mg/dl, only 3 patients were expired (5.26%) and 54 patients were discharged (94.64%).

Out of 13 patients who had serum creatinine> 3 mg/dl, 9 were expired (69.23%) and 4 were discharged (30.77%). [OR - 0.024; C.I. - 0.004717 to 0.1293; p<0.001 (HS)]

Table 5: Relation of Respiratory Rate with Outcome of Patient

Respiratory Rate	Expired	Discharge	Total
≤24	2	51	53
>24	10	7	17
Total	12	58	70

Out of 70 patients, 53 patients present with Respiratory rate ≤ 24 / min. and 17 patients with Respiratory rate > 24 / min. Out of 53 patients who had Respiratory rate ≤ 24 / min only 2 patients were expired (3.77%), and 51 were discharged (96.23%). Out of 17 patient who had Respiratory rate > 24 / min, 10 patients were expired (58.82) and 7 were discharged (41.18%). [OR - 0.027; C.I. - 0.004956 to 0.1521; p<0.001 (HS)]

Table 6: Relation of Serum Bilirubin (mg/dl) with Outcome of Patient

Bilirubin	Expired	Discharge	Total
≤10	8	56	64
>10	4	2	6
Total	12	58	70

Out of 70 patients, 64 patients present with serum Bilirubin ≤ 10 mg/dl and 6 patients with serum bilirubin > 10 mg/dl. Out of 64 patients who had serum bilirubin ≤ 10 mg/dl, 8 patients were expired (12.5%) and 56 were discharged (87.5%). Out of 6 patient who had serum bilirubin >10 mg/dl, 4 patients were expired (66.66%) and 2 were discharged (33.33%). OR - 0.071; C.I. - 0.01120 to 0.4554; p<0.001 (HS)

Table 7: Relation of Systolic BP in mm of Hg with Outcome of Patient

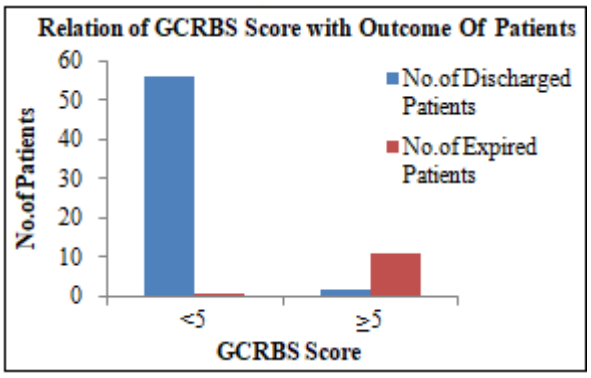
SBP	Expired	Discharge	Total
<90	9	11	20
≥90	3	47	50
Total	12	58	70

Out of 70 patients, 20 patients presented with systolic blood pressure < 90 mm of Hg and 50 patients with systolic blood pressure ≥ 90 mm of Hg. Out of 20 patients who had systolic blood pressure <90 mm of Hg, 9 patients were expired (45%) and 11 were discharged (55%).

Out of 50 patients who had systolic blood pressure ≥ 90 mm of Hg, 3 were expired (6%) and 47 were discharged (94%). [OR - 12.81; C.I. - 2.969 to 55.341; p<0.001 (HS)]

Table 8: Relation of GCRBS Score with Outcome of Patients

GCRBS Score	Expired	Discharge	Total
<5	1	56	57
≥5	11	2	13
Total	12	58	70



Out of 70 patients, 57 patients had GCRBS SCORE < 5 and 13 patientshad GCRBS Score ≥ 5. Out of 57 patients who had GCRBS SCORE <5, 1 patient was expired (1.75%) and 56 were discharged (98.25%).

Out of 13patients who had GCRBS SCORE ≥5 , 11 patients were expired (84.61%) and 2 were discharged (15.39%).

Out of 70 patient, 12 patient were expired (17.14%) and 58 were discharged (82.86%).

Out of 12 patient who had expired, 11 patient (91.66%) had GCRBS Score ≥ 5.

[OR - 0.01; C.I. - 0.001612 to 0.07384; p<0.001 (HS)]

4. Discussion

The clinical course of severe malaria is variable depending on the presence of one or several complications. There are numerous severity-of illness scoring systems that have been

developed and validated as tools to accurately assess populations of critically ill patients. Currently, the most commonly utilised scoring systems are the APACHE (acute physiology and chronic health evaluation) system, the MPM (mortality probability model), and the SAPS (simplified acute physiology score) system, all designed to predict outcomes in critical illness.

As seen in the previous studies cerebral malaria and acute renal failure are the major contributors to death. Since the neurological status of a cerebral malaria patient can vary from disoriented to stupor to coma, GCS being an easy to calculate quantitative variable has been used to allot a score for cerebral component. Similarly a respiratory rate of more than 24 has been used to identify patients having pulmonary oedema or ARDS which has a high case fatality rate. But contrary to the previous studies jaundice has been found to be an important predictor of mortality in this study. We observed that with the increase in bilirubin levelthe death rate also rises, more steeply with bilirubinlevels >10 mg/dl.
The GCRBS score has a possible score of 0 to 10,higher the score poorer the outcome. 5 parameters arerequired for its calculation namely GCS, Creatinine,Respiratory rate, Bilirubin and Systolic BP (mnemonicGCRBS). Out of these only two (Creatinine and bilirubin) are laboratory parameters and the restthree are clinical parameters which can be easilydetermined at the bedside. The most important advantageof this scoring system is that all the 5 parameters areto be assessed quantitatively for allotting a score,which would eliminate the possibility of observer bias

5. Conclusion

On the basis of observation we found that patient who presented with GCRBS score ≥ 5 have poor prognosis and it is a very good predictor of mortality with sensitivity 84.61% and Specificity 91.6%.

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