Original Research Article

GCRBS scoring system for predicting outcome in severe falciparum malaria

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Abstract

Background: Malaria is a protozoan disease caused by plasmodium species, transmitted by bite of infected female Anopheles mosquito, characterised by febrile paroxysms presenting with intermittent periodicity. It is diagnosed by Rapid antigen tests and blood smear tests. Severe malaria is almost exclusively caused by Plasmodium falciparum infection and can cause death within hours or days. Present study was done to give scoring system to predict the outcome in severe cases of falciparum malaria. **Materials and Methods:** This is a prospective study done on 100 patients diagnosed as severe falciparum malaria, admitted in the Department of General Medicine wards and Intensive Care Unit(ICU) of Kakatiya Medical College, Warangal, Telangana, India, between the period September 2015 to November 2017. GCRBS Scoring system was done on all patients using 5 parameters which includes GCS, Creatinine levels, Respiratory rate, Bilirubin levels and Systolic blood pressure. **Results:** The GCRBS score of 0-10 was given for all patients. The maximum score is 10 and least score is 0. Cutoff score was taken as 5. A score of >/= 5 was considered as having bad prognosis and score of < 5 was considered as having good prognosis. Our present study has a sensitivity of 86.95% and specificity of 94.8%. **Conclusion:** The GCRBS scoring system is simple and easy to calculate as 5 parameters are to be assessed to give a score. Hence it can be used as a bed side method to predict the outcome in severe falciparum malaria cases.

Key words: GCRBS, Malaria, Plasmodium falciparum

Introduction

Malaria is a protozoal disease caused by Plasmodium species transmitted by bite of female Anopheles mosquito[1]. The disease is endemic in several parts of the world, especially in tropical Africa, parts of South and Central America, India and South-East Asia. Severe malaria is almost exclusively caused by Plasmodium falciparum infection and usually arises 6–14 days after infection. Severe malaria can progress extremely rapidly and cause death within hours or days. Major complications occur in severe falciparum malaria which may have manifestations of cerebral malaria (coma), hypoglycaemia, renal impairment, severe anaemia, haemoglobinuria, jaundice, pulmonary oedema and acidosis followed by congestive heart failure and hypotensive shock. Thus severe falciparum malaria can lead to multiorgan failure and death. WHO in 1990 published the criteria to identify the severe cases[1]. A scoring system is necessary for the risk stratification of severe malaria cases[12]. Present study was done to give scoring system to predict the outcome in severe cases of falciparum malaria so that it will be help the clinician to give intensive care to the needy patients for better outcome.

Materials and methods

This is a prospective study done on total of 100 patients diagnosed as severe falciparum malaria, admitted in the Department of General Medicine wards and Intensive Care Unit(ICU) of Kakatiya Medical College, Warangal, Telangana, India, between the period September 2015 to November 2017. Institutional ethical clearance was taken for the study. All cases were confirmed as falciparum malaria by Rapid antigen tests and peripheral blood smear examination. coma scale, C-Creatine levels (mg/dl), R-Respiratory rate/min, B-Bilirubin(mg/dl),

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S-Systolic blood pressure(mm/hg). For all the 100 casesof plasmodium falciparum malaria included in the study,following tests were conducted along with detailed history and physical examination.Complete blood picture with thick and thin smears, Glasgow coma scale, Fasting Blood Sugar(FBS), Post Lunch Blood Sugar(PLBS), Ultrasonography(USG- Abdomen),Liver Function Tests(LFT),Renal Function Tests(RFT),Arterial Blood Gas(ABG) analysis were done..All the data was entered using Excel sheet and analyzed using SPSS version 21.

Table 1: GCRBS Score

Parameter		Score
GCS	3-6	3
	7-10	1
	11-15	0
Creatinine (mg/dL)	>3	2
	</=3	0
Respiratory rate	>24	2
	</=24	0
Bilirubin(mg/dL)	>10	2
	</=10	0
Systolic Blood pressure	<90	1
	>/=90	0

GCRBS score of 0-10 is given based on the five parameters mentioned above. The maximum score is 10 and least score is 0. In our present study, cutoff of GCRBS score of 5was taken to grade the severity. The higher the score, the poorer the prognosis.

Results

The age of the patients in our present study ranged from 21-70 yrs.

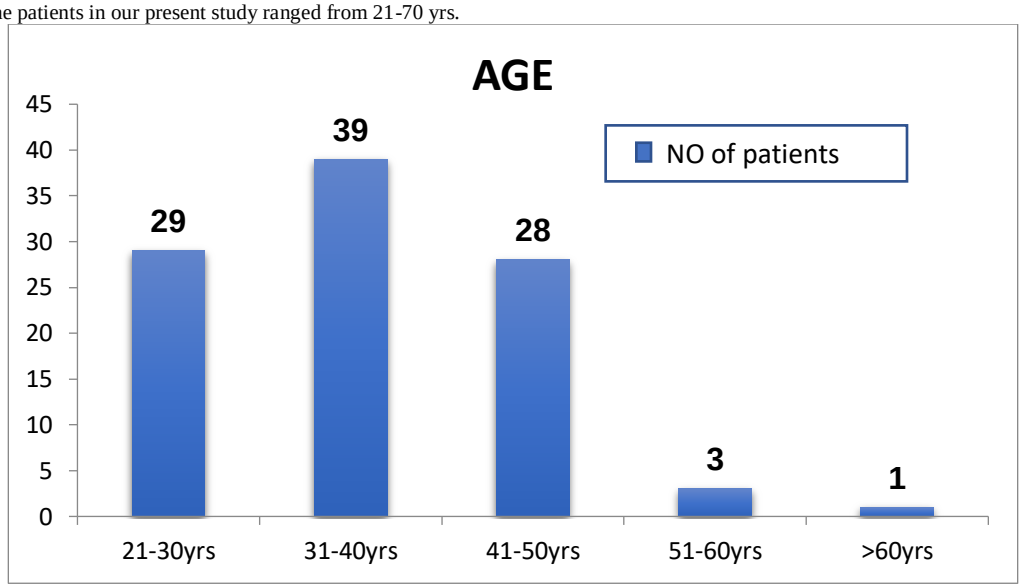

Figure1: Age wise distribution of study population(n=100)

Figure 1 shows age distribution of patients in our study. The majority of patients were in the age group of 31-40yrs followed by 29 patients belong to 21-30yrs, 28 patients belong to 41-50yrs, 3 patients belong to 51-60yrs and 1 patient belong to >60yrs age group.

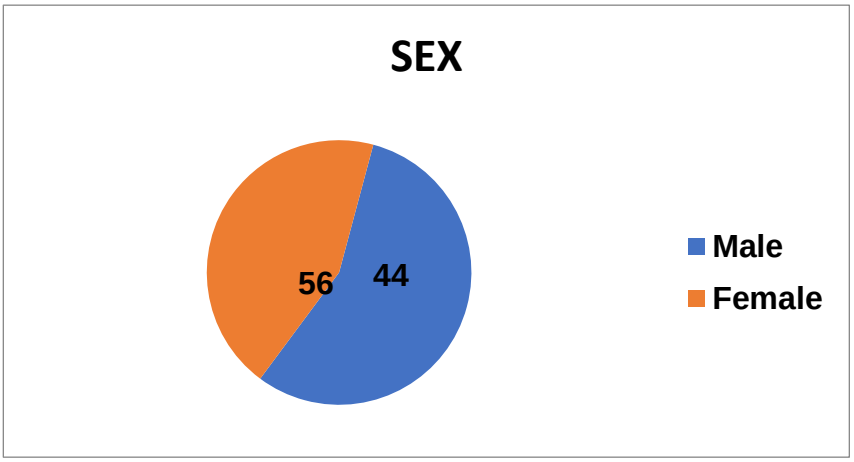

Figure 2: Gender wise distribution of study population (n=100)

Figure 2 shows gender wise distribution of study population of which 56 patients are males and 44 are females.

Table 2: Comparison of Age groups of study population with Glasgow coma scale(GCS) (n=100).

Age groups in Years	GCS(11-15)	GCS(7-10)	GCS(3-6)
21-30yrs	21	04	04
31-40yrs	27	09	03
41-50yrs	11	13	04
51-60yrs	01	02	00
60-70yrs	01	00	00
Total	**61**	**28**	**11**

On comparison of age with Glasgow coma scale, the above table shows that out of 100 patients, 61patients had GCS score of 11-15 ,28 patients had GCS score of 7-10, 11 patients had GCS score of 3-6 in the age groups of 21-70yrs respectively.

Out of 100 patients 11 patients with GCS score of 3-6 showed bad prognosis.

Table 3: Comparison of age groups of study population with serum creatinine levels(n=100).

Age groups in years	Serum creatinine levels	
	>3(mg/dL)	</=3(mg/dL)
21-30yrs	07	22
31-40yrs	11	28

41-50yrs	03	25
51-60yrs	02	01
60-70yrs	00	01
Total	**23**	**77**

On comparison of age withserum creatinine levels,the above table shows that out of 100 patients 23 patients had serum creatinine levels of >3mg/dl and 77 patients had serum creatinine levels of <3mg/dl in the age groups of 21-70yrs respectively.
Out of 100 patients 23 patients with serum creatinine levels of >3mg/dl showed bad prognosis.

Table 4: comparison of age group population with respiratory rate(n=100).

Age groups in years	Respiratory rate/min	
	>24/min	<24/min
21-30yrs	05	24
31-40yrs	03	36
41-50yrs	12	16
51-60yrs	02	01
60-70yrs	01	00
Total	**23**	**77**

On comparison of age with respiratory rate ,the above table shows that out of 100 patients 23 patients had respiratory rate of >24/min, 77 patients had respiratory rate of <24/min in the age groups of 21-70yrs respectively .
Out of 100 patients 23 patients who had respiratory rate of >24/min showed bad prognosis.

Table 5: Comparison of age group population with serum bilirubin levels (n=100).

Age groups in years	Serum bilirubin levels(mg/dL)	
	>10mg/dl	<=10mg/dl
21-30	05	24
31-40	04	35
41-50	01	27
51-60	00	03
>60	00	01
Total	**10**	**90**

On comparison of age with serum bilirubin levels ,the above table shows that out of 100 patients 10 patients had serum bilirubin levels >10mg/dl, 90 patients had serum bilirubin levels <10mg/dl in the age groups of 21-70yrs respectively .
Out of 100 patients, 10 patients with serum bilirubin levels >10mg/dl showed bad prognosis.

Table 6: comparison of age group population with systolic blood pressure

Age groups in years	Systolic blood pressure(mmhg)	
	>90mmhg	<90mmhg
21-30	27	02
31-40	30	09
41-50	22	06
51=60	01	02
>60	00	01
Total	**80**	**20**

On comparison of age with systolic blood pressure ,the above table shows that out of 100 patients 80 patients hadsystolic blood pressure of >90mm/hg and20 patients had systolic blood pressure of <90mm/hg in the age groups of 21-70yrs respectively .
Out of 100 patients, 20 patients with systolic blood pressure of <90mm/hg showed bad prognosis.

Table 7: GCRBS score

GCRBS total score	No. of patients
<5	**77**
5	**02**
6	**04**
7	**07**
8	**07**
9	**02**
10	**01**
TOTAL	**100**

Out of 100 patients, 77 patients had a GCRBS score of <5 and 23 patients had GCRBS score of >/=5. Those patients with GCRBS score of >/=5 presented with bad prognosis.

Table 8: computation of sensitivity and specificity for GCRBS score

GCRBS score	Patients presented with multi organ failure	Patients presented without multi organ failure	Total	
>/=5	20	03	23	**Sensitivity = 86.95%**
<5	04	73	77	**Sensitivity = 94.8%**
Total	**24**	**76**	**100**	

In our present study, out of 23 patients with GCRBS score(>/=5), 20 patients developed multiorgan failure. Out of 77 patients with GCRBS score(<5) , 04 patients developed multiorgan failure. Total of 24 patients developed multiorgan failure in our study. They needed long stay in the hospital and treated in Intensive Care Unit[11] for more than 10 days and were discharged later. Our present study has a sensitivity of 86.95% and a specificity of 94.8%.

Table 9: computation of sensitivity and specificity for GCRBS score

Study	Sensitivity	Specificity
B N Mohapatra et al[8]	85.3%	95.6%
Satish Kumar et al[9]	84.61%	91.6%
Present Study	**86.95%**	**94.8%**

Our present study has a sensitivity of 86.95% and a specificity of 94.8% which is co-relating well with the studies done by B N Mohapatra et al[8] and Satish Kumar et al[9].

Discussion

Falciparum malaria can cause severe complications leading to multiorgan failure and death. Several scoring systems have been developed in evaluating the severity and progression of critically ill patients. These include the Acute Physiology and Chronic Health Evaluation II (APACHE II)[2] (Knaus et al, 1985), Simplified Acute Physiology Score (SAPS II)[10] (Le Gall et al, 1993), Sequential Organ Failure Assessment score (SOFA score)[7] (Vincent et al, 1998), Malaria Severity Assessment score (MSA)[6] (Mishra at al, 2007)[3], Malaria Severity Score (MSS)[5] (Mohapatra and Das, 2009), GCRBS score (Mohapatra, 2014), Clinical Scoring Index (CSI)[4] (Teaño et al, 2002).

APACHE II score[2] is the sum of the acute physiology score (vital signs, oxygenation, laboratory values), Glasgow coma score, age and chronic health points. It is more popularly applied in patients of acute critical illness and has a cutoff point at a score of 24.

Malaria Severity Assessment Score (MSA)[6] is based on four parameters namely severe anemia, acute renal failure, respiratory distress and cerebral malaria. Points are given to each of the parameter and the final score is calculated adding all the four points.

Sequential Organ Failure Assessment score (SOFA score)[7] is based on six different scores, one each for the respiratory, cardiovascular, liver, coagulation, renal and central nervous systems.

Clinical Scoring Index(CSI)[4] for predicting outcome in cerebral malaria is based on assessing level of consciousness, multiple convulsion, labored respiration, circulatory collapse and abnormal bleeding . It has a score of 0-14 with an optimum score of 7.

But GCRBS scoring system done in our present study is very simple and easy to calculate using Glassgow coma scale, creatinine levels, respiratory rate, bilirubin levels and systolic blood pressureof the patients admitted with severe falciparum malaria.

In our present study GCRBS score of >/=5 was considered with bad prognostic outcome.

We had a sensitivity rate of 86.95% and specificity rate of 94.8%.

In a study done on GCRBS scoring system to predict outcome of falciparum malaria by B N Mohapatra et al[8] , they had a sensitivity of 85.3% and specificity of 95.6% which correlated with our present study.

In a study done on GCRBS scoring system to predict severity of falciparum malaria by Satish Kumar et al[9] , they had a sensitivity of 84.61% and specificity of 91.6% which correlated with our present study.

Conclusion

In present study out of 100 patients with severe falciparum malaria, 77 patients have GCRBS cutoff score <5, of which 04 patients developed multi organ failure.23 patients have GCRBS cutoff score >/=5,of which 20 patients presented with multi organ failure.Total of 24 patients who developed multiorgan failure had a long stay in the hospital Intensive Care Unit for more than 10 days and were later discharged.

The GCRBS scoring system is very simple and easy to calculate using 5 parameters namelyGlassgow coma scale, creatinine levels, respiratory rate, bilirubin levels and systolic blood pressure of the patient. It can be used to predict the outcome in severe falciparum malaria cases as our present study has a sensitivity of 86.95% and specificity of 94.8%. Thus ,GCRBS scoring system can be used at bed side to predict the severity of falciparum malaria cases which can help the clinicians to give intensive care to the needy patients at the earliest for better outcome.

Source of funding

None

Conflicts of interest

Nil

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