ORIGINAL ARTICLE

Prospective Receptor Operating Characteristics analysis of AIMS65 Score as predictor of outcomes of upper gastrointestinal bleeding in Patan Hospital

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Abstract

Introduction: AIMS65 is a new score developed to predict outcomes of Upper Gastrointestinal Bleeding. It is simpler than other scores. The objectives of this study were to study its usefulness in predicting inpatient mortality, intensive care unit stay, and blood transfusion.

Method: This was a hospital based prospective, analytical and observational study. AIMS65 score was calculated of each patient with upper gastrointestinal bleeding admitted to medicine department of Patan Academy of Health Sciences between 2021 March to 2022 March till predetermined sample size of 84 patients was met. Those patients who refuse to consent, get referred to other centres, leave against medical advice and those whose bleeding source was found to be other than upper gastrointestinal tract were excluded. Outcomes of inpatient mortality, Intensive Care Unit(ICU) stay and blood transfusion requirement were assessed. Area under receptive operating characteristics curve generated and optimal cut-off determined using Delong statistics.

Result: Of 92 patients included for analysis, median AIMS65 score was one. Rates for mortality, ICU stay and blood transfusion were 13%, 31% and 55% respectively. AUC of inpatient mortality, ICU stay and blood transfusion was 0.792, 0.723 and 0.745 respectively. The optimal AIMS65 score cutoff for each outcome was two or more.

Conclusion: Although AIMS65 score can predict outcome of inpatient mortality, blood transfusion requirement and ICU admission, itneeds to be considered along with other factors and cannot be used as sole predictor.

Keyword: Risk assessment, Gastrointestinal Hemorrhage, Hospital Mortality, Nepal

Introduction

Prognostic scales are developed to predict outcomes of Upper Gastrointestinal Bleed (UGIB) like Rockall score, Glassgow-Blatchford score (GBS) and AIMS65 score.[1,2,3] AIMS65 is a new score developed and validated in 2011 that uses simple objective parameters for predicting mortality, rebleeding and need of intervention or blood transfusion.[4]

Multiple studies have shown AIMS65 score to be statistically significant in predicting inpatient mortality, requirement of Intensive Care Unit(ICU) admission and blood transfusions.[5,6,7] In a study in Australia AIMS65 was superior to GBS but equivalent to full Rockall Score(fRS) in predicting inpatient mortality and superior to both scores in predicting ICU admission.[8] Another study done in India showed AIMS65 score to be statistically useful in predicting inpatient mortality and blood transfusion.[9]

A study in Patan Hospital, out of 301 patients, 94% were diagnostic by Upper GI Endoscopy(UGIE) and 40% of those were variceal.[10] However, no study regarding the use of AIMS65 score was found in Nepal using Google Scholar and PubMed search.

Being a newer score developed in 2011, further study of this score would add more evidence to its use in different settings. This is particularly useful as AIMS65 is a relatively simple,objective, bedside score compared to other scores.

Method

This was a hospital based prospective, analytical and observational study. The objectives were to calculate AIMS65 score for inpatients with upper gastrointestinal bleed (UGIB), to study proportion, generate Area Under Receptor Operative Characteristics (AUROC) and determine optimal cut-off of inpatient mortality, blood transfusion requirement and ICU

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admission among patients with UGIB. The study was done in Patan Hospital during 2020 to 2022. Ethical approval was taken from institutional review committee of Patan Academy of Health Sciences (IRC-PAHS). Written consent was obtained from patient/legal guardian.Confidentiality of patient was maintained throughout study and analysis. Data was collected with secrecy and stored either physically or by software like Microsoft Excel or Epiinfo in password protected computer of researcher. As there was no intervention, no harm was caused to any patient. Since the relevant investigations are all part of workup for patients with UGIB no additional costs were borne by patients due to this study.

All patients more than 14 years old presenting with history or examination findings of melena, hematemesis or fresh rectal bleed attributed to upper gastrointestinal tract and admitted to medicine department with diagnosis of UGIB were included for study. Those patients who refuse to provide consent, leave against medical advice, get referred to other center or those whose source of bleeding were found to be other than UGI trace were excluded from study. Data collection period was from March 21 2021 to March 20 2022 till desired minimum sample size was reached. Sample size was calculated using web based statistical software with parameters tabulated on easyROC (http://www.biosoft.hacettepe.edu.tr/easyROC/#tab-4399-7 (Last accessed July 13 2022).Data source for AUC was used from previous studies.[8,9] Allocation ratio was set based on percentage of inpatient mortality and blood transfusion study done in Nepal.[11] The sample size calculation was based on statistical analysis by Obuchowski et al.[12] Desired minimum sample size was 84 with at least 12 mortality cases, 10 cases of ICU admission and 24 cases requiring blood transfusion. All consecutive cases from March 21 2021 to March 20 2022 till desired minimum sample size reached were included.

Data was collected as per proforma and entered in spreadsheet by Google Sheets. Hematemesis defined as vomiting of blood. Melena defined as black tarry stool attributed to UGI bleed. Age and sex were recorded. Pulse, Systolic blood pressure, mental status was recorded between triage and admission. The value which was the worst during that period was taken. Serum albumin, PT/INR, and hemoglobin were taken during admission. UGI endoscopy was done within 24 hours of admission in most cases. Outcomes were recorded during discharge of patient.

For data analysis, Google sheet was converted to Microsoft Excel spreadsheet and analyzed in Microsoft Excel as well as EZR software(R based programming software, version 1.50). All input variables were tested for normal distribution by Kolmogorov Smirnov (KS) test. Mean with standard deviation was used for normal distribution and median with range for skewed distribution. Other analysis was done as per specific objectives and pre-specified dummy tables. Delong statistics was used for ROC analysis and the sum of sensitivity and specificity was used for determining optimal cutoff. Some of the ROC analysis was done with the help of EasyROC, a web based software. Additional and sub group analyses were done as per the data.

Result

Of 110 patients considered for study, 92 were included after excluding 18 patients. The non-upper gastrointestinal tract (UGI) sources of bleeding were colonic in five and hemoptysis in one. One patient was referred outside for ICU admission from ward due to unavailability of bed. Four of them left against medical advice. Four of the data were incomplete as outcomes could not be traced. Three admitted to ward were advised for admission to ICU but refused ICU and were on “Do not intubate/ do not resuscitate” order. One of them survived to discharge. Excluding these, total of 92 patients were included for data analysis.

Fifty percent of patients had age less than 50 years. Thirty-two out of Ninety-two patients (34.7%) were females. Mean hemoglobin and mean serum albumin were lower than reference range. Other baseline values are listed in Table 1. Age, pulse, systolic blood pressure and hemoglobin were normally distributed. Albumin, INR, and GCS were positively skewed.

Table 1: Baseline characteristics among patients with UGIB, N=92

Parameter	Median(Range)	Inter quartile range
Age (years)	50(19-86)	40-57
Albumin (gm/dl)	2.6(1.7-4.5)	2.3-3.1
Hb (gm/dl)	8.7(3.5-15.8)	7.1-10.8
INR	1.43(0.83-12.50)	1.20-1.74
Pulse (beats/minute)	100(0-144)	88-110
SBP (mm of Hg)	110(0-156)	100-130
GCS	15(3-15)	15-15

The median AIMS65 score was one (Range : 0-4). None of the patients had AIMS65 score of five. The distribution is shown in (Figure 1). Left axis is number of observations and right axis is AIMS65 score.

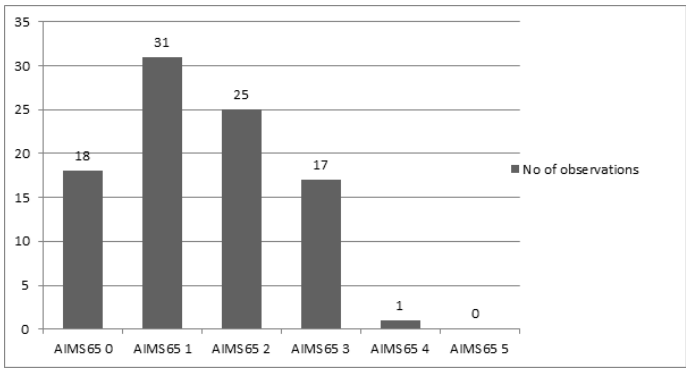

Fig 1: Graph showing distribution of AIMS65 Score, N=92

Among the AIMS65 score parameters, 59 (64%) of all patients had serum albumin less than three, 35 had INR > 1.5 (34.04%), 11 had GCS < 14 (11.96%), 21 (22.83%) had systolic blood pressure<=90 mm Hg and 10 (10.87%) had age >=65 years. Thirteen percent (12 of 92) of all patients had mortality, 31% (29 of 92) stayed in ICU and 55% (51 of 92) were transfused blood or blood products (Table 2). The median AIMS65 score among those with mortality, those staying ICU and those requiring blood were two respectively.

Table 2: Percentage of UGIB patients with inpatient mortality, blood transfusion requirement and ICU stay

Outcome	No of patients(n=92)	Percentage	Median AIMS65 Score
Mortality	12	13	2
ICU	29	31	2
Blood Transfusion	51	55	2

The AUC value and the optimal cutoffs for each of the outcomes are listed inTable 3.

Table 3: AUC value and optimal cutoff of AIMS65 score for predicting outcomes of mortality, ICU stay, blood transfusion requirement in UGIB patients

OUTCOMES	AUC	Lower limit(95%CI)	Upper Limit(95%CI)	Optimal Cutoff of AIMS65 score
Mortality	0.792	0.65	0.934	2
Need of ICU	0.723	0.607	0.835	2
Need for blood transfusion	0.745	0.646	0.844	2

Discussion

The mean age of 49 years is similar to studies done by Yuba Raj Sharma et al[10] in Patan Hospital in 2010 and by Umid Kumar Shrestha et al in 2014.[13] The age group is younger than that by MN Parvez et al in East India[14],Ibrahim M. Alruzug et al in Saudi Arabia (mean 57 years) as well as that of Western studies.[15] This might be due to larger proportion of variceal bleed in my study as variceal bleed tends to present younger.[15] Variceal bleeding accounted for 59% of patients in my study. This is in contrast to study by Yuba Raj Sharma et al[10] in 2016 where variceal bleeding accounted 40% in the same center. This might be due to COVID pandemic as non variceal bleeding cases were decreased during COVID pandemic.[16] Patients with variceal bleeding tends to present as hematemesis[17] hence are likely to present to emergency during pandemic. The median AIMS65 score was one for the sample and two in those with positive outcomes. Rates for mortality, ICU stay and blood transfusion were 13%, 31% and 55% respectively. The mortality rate of 13% is higher in our study as compared to AJ Staneley et al[5](7% mortality), however it is comparable to those reported in Nepal by Shilpakar O et al[11] (14%,n=272). These differences might be due to advanced treatment facilities such as surgical/interventional modalities, subspecialized care by gastroenterologists, better endoscopic treatment modalities which were used in study by AJ Stanley et al but not available in our center at the time of the study. In terms of AUC this study showed that AIMS65 score is statistically significant for predicting outcomes of inpatient mortality, ICU stay and blood transfusion requirement. AIMS65 cutoff of two or more would successfully detect 91.7 % of mortality cases; however, specificity is low at 60%. Using a cutoff of one would result in same sensitivity but reduced specificity (21.2%) whereas a cutoff of three would result in a reduced sensitivity of 58.33% and increased specificity of 86.25%. Since mortality cases should not be missed, high sensitivity is desirable. Also, optimizing cutoff for maximum of sensitivity and specificity, AIMS65 score of two is an ideal cutoff for mortality. This resulted in negative predictive value of 98.0%. Similarly, the cutoff of two would be 72.4% sensitive and 65.1% specific for ICU stay. A cutoff of one would lead to sensitivity of 89% but very low specificity of 24%. Meanwhile, a cutoff of three would be 41% sensitive but 90% specific. For predicting blood transfusion requirement, a cutoff of two would be 62.7% sensitive and 73.2% specific. A cutoff of one would be 96% sensitive but 39% specific and a cutoff of three would give sensitivity of only 27% with increased specificity of 90%. Hence AIMS65 score of two or more is the optimal cutoff for predicting mortality, ICU stay or blood transfusion.

Only 1.08% (one out of ninety-two) cases will be missed by AIMS65 cutoff of two or more for mortality. For ICU related outcome, using AIMS65 cutoff of two would still miss 8.7% (eight out of ninety-two) of all patients with UGIB. The American College of Gastroenterology (ACG) suggest that "patients presenting to the emergency department with upper gastrointestinal bleeding (UGIB) who are classified as very low risk, defined as a risk assessment score with less than one percent false negative rate for the outcome of hospital-based intervention or death (e.g., Glasgow-Blatchford score 0–1), be discharged with outpatient follow-up rather than admitted to hospital (conditional recommendation, very-low-quality evidence). "(ACG Clinical Guideline: Upper Gastrointestinal and Ulcer Bleeding 2021).[18] Using this criteria for AIMS65 score as a score for discharge, if AIMS65 score of one or more was used as cutoff, 18 out of 92 (19.5%) could be discharged from emergency itself. One out of those discharged would expire (5.56%) and four out of them (22%) would reach any outcome of blood transfusion, ICU stay or mortality. In contrast in a multicentre study by A J Stanley et al[5], for GBS score of one or less, 19.2% (564 patients) could be discharged from emergency, out of those 564; 0.4% had mortality, 3.4% had combined outcome of blood transfusion, intervention or death. In the same study, using a cutoff of AIMS65 score of zero for discharge would lead to 34.6% (865 of patients) being discharged out of those 865, mortality would be 0.7% and combined outcome would be 25% of those discharged (n=865). The outcomes for AIMS65 score are similar to my study. The higher mortality in my study (5.56% vs 0.7%) is most likely due to small sample size (18 vs 865 patients with AIMS65 score of zero). Hence it could be inferred that AIMS65 score is not a suitable score for triaging the patient for ER.

For predicting mortality though, AIMS65 score has consistently been more useful than other scores. In this study, AIMS65 score had AUC of 0.796. This is similar to study done by Sanjay Chandnani et al in Western India (AUC 0.716).[9] Other studies done globally such as that by Saltzman et al[4] (AUC 0.8), Hyett et al6 in USA (AUC 0.93), Marcus Robertson et al[19] in Australia (AUC 0.80), and A J Stanley et al5 globally (AUC 0.77 for 30-day mortality). For requirement of blood, AUC was 0.745 (95%CI 0.646 to 0.844) and compares similarly to studies by Sanjay Chandnani et al[9] in Western India (AUC 0.69), Hyett et al[6] in USA (AUC 0.65), Marcus Robertson et al[19] in Australia (AUC 0.72). For ICU stay, AUC of my study was 0.723 (95% CI 0.607 to 0.835) and compares with Hyett et al[6] in USA (AUC 0.69), Marcus Robertson et al[19] in Australia (AUC 0.74), Yi-Chen Lai et al[20] in Taiwan (AUC 0.77 among cirrhotic patients), Min Seong Kim et al[21] in Korea (AUC 0.73) and Yajie Li et al[22] in China (AUC 0.737 in elderly >= 65 and 0.854 in younger patients). Thus, AIMS65 score is acceptable in predicting inpatient mortality, ICU stay, blood transfusion requirement in my study.[23]

The main strength of this study was that it was a prospective

study done with prior sample size calculation and with little cost.Although numerous studies are available worldwide on the use of the AIMS65 score in predicting mortality, limited studies have been conducted on predicting ICU requirements. Although there are some studies done regarding Rockall score and UGIB in Nepal and India, very few studies are being done for AIMS65 score in this region.There are some limitations to this study. Only AIMS65 score was analyzed. It would have been more informative if other scores for UGIB such as Rockall score, Glasgow-Blatchford score, PNED score and newer ABC score could have been added and compared. However, incorporating other scores would require larger sample size, enrolling which was challenging due to time limitation of one year. Due to COVID pandemic and other challenges, the limited sample size meant that subgroup analysis was less reliable. The confidence intervals were wider and outlier variables had oversized effect due to low sample size. Rebleeding and 30-day mortality were also not assessed as outcome due to uncertainty in assuring follow up due to COVID restrictions. Although criteria for assessing mortality or blood transfusion were clear, criteria of ICU stay werenot well defined and left to be judged on individual patient basis. This was both the limitation of this study as well as one of the rationales for carrying out this study.

Conclusion

The median AIMS65 score in the study population was one. Mortality among UGIB patients was 13% (12 out of 92), ICU stay was present in 31% and blood transfusion was required in 55%. Area under ROC curve was 0.792, 0.723 and 0.745 for inpatient mortality, ICU stay and blood transfusion requirement respectively. AIMS65 score is acceptable in predicting inpatient mortality, ICU stay, blood transfusion requirement. Among the patients with UGIB in this study, the optimal cutoff of AIMS65 score for inpatient mortality, ICU stay, blood transfusion was two or more for high risk stratification. Further areas of research would be to validate the study in sub-urban/rural settings and also compare the effectiveness of AIMS65 score in variceal and non-variceal subgroups.

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Conflict of Interest: None

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