Comparison of Risk Scores for Predicting In-hospital Mortality among Patients Presenting with Acute Upper Gastrointestinal Bleed: A Retrospective Study from a Tertiary Care Centre, Chennai, India

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ABSTRACT

Introduction: Acute Gastrointestinal (GI) bleeding results in 5% of admissions to an Emergency Department/Room (ER), with mortality rates ranging from 2 to 15%. To predict the outcomes of these patients, multiple scoring systems have been developed. Early detection of individuals at high risk of mortality could allow for more targeted care including specialised care and early therapies, which could improve outcomes. Glasgow Blatchford Score (GBS), Pre-endoscopy and Rockall score, AIMS-65 (Albumin, International Normalised Ratio, Altered Mental status, Systolic blood pressure, Age >65 years), and the recently proposed ABC (Age, Blood parameters, Co-morbidities) score are some of the risk scores that have been devised for risk stratification. According to recent studies, the discriminative performance of these current scores for predicting patient mortality is relatively weak.

Aim: To compare the risk scores for predicting in-hospital mortality among patients presenting with acute upper gastrointestinal bleed.

Materials and Methods: A retrospective observational study was conducted on patients referred to the ER of a tertiary care hospital, Chennai, Tamil Nadu, India, with an acute upper GI bleed (characterised as haematemesis, coffee coloured vomitus, or melena) from July 2018 to June 2020. Data collected from medical records included detailed clinical history, vitals, relevant blood investigations, patient requirement for blood transfusion, endoscopic therapy, surgical procedures, radiological intervention along with mortality. The data was analysed using appropriate biostatistics Statistical Package for Social Sciences (SPSS) version 26.0, paired t-tests were performed to calculate the p-values and a p-value <0.05 was considered significant.

Results: The study comprised a total of 112 patients. The study population's median age was 53 years, with a male predominance (83.92%). The presenting complaint was haematemesis in 76.8% of the patients and melena in 23.2%. Ischaemic heart disease (10.71%), cirrhosis (25%), and malignancy (2.68%) were the most common co-morbidities. American Society of Anesthesiologists (ASA) grade III accounted for 45.3%, ASA grade II for 25.6%, and ASA grade I for 28.6%. Following endoscopy, the source of upper GI bleed was noted to be variceal in 39.3% of cases, gastric/duodenal ulcers in 25.9%, erosive changes in 16.1%, and tumour bleed in 2.7% of cases. Endoscopic mode of treatment was performed in 44.6% and 0.9% required surgical intervention. Mortality occurred in 11 patients (9.82%). Based on Area Under the Receiver Operating Characteristics (AUROC), AIMS-65 excelled over other scores in predicting mortality {AIIMS-65 (AUROC; 95% CI) 0.908 (0.85 to 0.97); p-value <0.001, Glasgow-Blatchford score (GBS) 0.818 (0.71-0.93) p-value <0.001, Pre-Rockall 0.756 (0.63-0.89) p-value <0.001, Rockall 0.894 (0.82-0.97) p-value <0.001, ABC 0.778 (0.65-0.90) p-value=0.003}.

Conclusion: Systolic blood pressure, heart rate, blood urea, International Normalised Ratio (INR), and albumin showed significant association with mortality. Risk scores encompassing albumin have better mortality prediction. AIMS-65 outperformed other risk scores in predicting mortality, even outperforming the postendoscopy rockall score. Hence, AIMS-65 can be used to stratify patients in the emergency room early to reduce mortality.

Keywords: Age, Blood parameters, Co-morbidities score, Glasgow-blatchford score, Mortality, Rockall, Risk stratification

INTRODUCTION

Acute Upper Gastrointestinal tract Bleeding (AUGIB) is a medical emergency with varying presentations. Reported incidence of upper gastrointestinal tract bleeding is at 67-103 per 100,000 adults per year [1,2]. Mortality rates from AUGIB have been steadily decreasing and reported in the range of 2-8% in the recent years [3]. This has been achieved with the help of early risk stratification, using various pre-endoscopy and postendoscopy risk scoring systems that can predict outcomes including need for hospital-based intervention, endoscopic therapy, and mortality risk [4].

Commonly used risk scores for UGIB include pre-endoscopy and postendoscopy Rockall score, Glasgow-Blatchford score (GBS), AIMS-65 score and recently proposed ABC (Age, Blood tests,

Co-morbidities score). Complete Rockall score or postendoscopy Rockall score was developed in 1996 and was validated to predict risk of mortality [3].

Glasgow Blatchford Score was developed in 2000, has high accuracy in predicting patients that require hospital-based interventions, apart from predicting rebleeding and mortality and its use in Emergency Department/Rooms (ER) has resulted in 15-20% reduction in hospital admissions [5].

Subsequently another score named AIMS-65 was developed in 2011 with aim to predict in-hospital mortality, which took into consideration serum albumin, International Normalised Ratio (INR), impaired mental status, systolic blood pressure and age >65 years [6]. In 2020, a risk score named ABC score was proposed to predict

mortality of patients presenting with both upper and lower GI bleed, which considered age, blood investigations and co-morbidities [7].

In contrast to predicting low risk group, discriminative performance of these scores for prediction of high risk and mortality is relatively poor. AIMS-65 has shown better predictability for mortality than GBS and Rockall score, but reported Area Under Receiver Operator Characteristics (AUROCs) curves are not higher than 0.80, limiting its utility in clinical practice [5,6,8-10].

Recent international multicentre study from Laursen SB et al., using ABC score for both upper and lower Gastrointestinal bleed has shown greater predictability for mortality with AUROC (0.81-0.84) [7].

The risk scores (GBS, pre and postendoscopy Rockall score, AIMS-65, and ABC) were developed on a study cohort which is demographically different from the cohort of patients presenting at a tertiary centre in South India, difference being the present study cohort with a lower median age (<60 years), higher percentage of variceal bleed (>40%) and a higher mortality, necessitating evaluation of the utility of these scores in risk stratifying these patients [11-15].

The aim of the present study was to compare risk scores (GBS, Pre and Postendoscopy Rockall score, AIMS-65, and ABC) to predict in-hospital mortality.

MATERIALS AND METHODS

This single centre retrospective observational study was conducted in Department of Medical Gastroenterology at Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamil Nadu, India (tertiary care centre), from July 2018 to June 2020. The study approval was obtained from the Institutional Ethical Committee (Ref CSP-MED/20/NOV/63/138) in September 2020. The database was generated by searching for key terms in discharge files: Upper Gastrointestinal Bleed (UGIB) and Variceal bleed presented to ER. UGIB was defined as presentation with coffee-ground vomiting, haematemesis, or melena [7].

Inclusion criteria: Patients aged over 18 years presenting to ER with a primary suspected diagnosis of AUGIB were included in the study.

Exclusion criteria: Inpatient bleed, chronic GI bleed defined as occurring for longer than 3 days or presentation as iron deficiency anaemia, self discharged or missing information, death prior to initial assessment were excluded from the study [16].

Study Procedure

Data collection: Data collected included clinical assessment variables i.e, presenting complaint, history of haematemesis or melena, syncope, hepatic disease and cardiac failure, other co-morbidities to assess American society of Anaesthesiologists (ASA) score [17], systolic blood pressure, blood tests includes Haemoglobin (Hb), serum albumin, International Normalised Ratio (INR) and Renal Function test (RFT), Whether the patient required endoscopic therapy; surgical procedures, radiological intervention, and mortality. Risk scores for UGIB included pre-endoscopy and complete Rockall score, Glasgow-Blatchford score (GBS), AIMS-65 score and ABC (Age, Blood tests, Co-morbidities score) [3,5-7].

Hepatic disease was defined as a known history, or clinical and laboratory evidence, of chronic or acute liver disease. Cardiac failure was defined as 'a known history, or clinical evidence of cardiac failure'.

STATISTICAL ANALYSIS

Statistical Package for Social Sciences (SPSS) IBM statistics version 26.0 for statistical analysis of the data was used. Outcome variable was generated by giving a score of 0 for survivors and 1 for in-hospital mortality. Paired t-tests were performed to calculate the p-values when performed on the cohorts comparing survivors and non survivors, a p-values <0.05 was considered significant. This then created a Receiver Operator Characteristic (ROC) curve that produced 95% CIs for the area under curve for various scores.

RESULTS

A total of 112 patients were included in the study. The median age was 53 years with mean age of 53.7±15.6 years, 83.9% were males, the common presentation was with haematemesis (76.8%). Among the co-morbidities, 25% were already diagnosed as cirrhosis liver and 10.7% had ischaemic heart disease. Out of total 112 patients, 45.3% belonged to ASA III and 25.9% in ASA II, remaining 28.6% belonged to ASA I. Patient's characteristics, endoscopic findings, interventions, outcomes, and risk scores are summarised in [Table/Fig-1]. Computing various risk assessment scores, the median scores noted were 9, 2, 4, 1, 3 for GBS, pre-endoscopy Rockall, Rockall (post endoscopy) AIMS-65 and ABC score, respectively. In hospital mortality was observed in 9.8% (11/112).

Parameters	n, %
Age in years (Median)	53
Sex (male)	94 (83.9%)
Presenting complaint	
Haematemesis	86 (76.8%)
Melena	26 (23.2%)
Co-morbidity	
Ischaemic heart disease	12 (10.71%)
Liver cirrhosis	28 (25%)
Malignancy	3 (2.68%)
American society of Anaesthesiologists (ASA) score [17]	
I	32 (28.6%)
II	29 (25.6%)
III	51 (45.3%)
Circulatory status (median)	
Systolic BP (mmHg)	110 (50-190)
Pulse rate (beats/min)	90 (64-138)
Blood parameters (median)	
Haemoglobin (g/dL)	9.7 (3.1-18.1)
Blood Urea (mmol/L)	6.6 (0.7-31.7)
Creatinine (mg/dL)	0.8 (0.4-11.1)
Albumin (g/dL)	3.2 (1.6-4.7)
INR	1.23 (0.8-4.1)
Endoscopic findings	
Normal/No Stigmata of Recent Haemorrhage (SRH)	10 (8.9%)
Erosive	18 (16.1%)
Mallory Weiss Tear	8 (7.1%)
Gastric/Duodenal ulcer	29 (25.9%)
Variceal bleed	44 (39.3%)
Upper GI cancer	3 (2.7%)
Intervention	
Mortality	11 (9.8%)
Endoscopy treatment	50 (44.6%)
Surgery	1 (0.9%)
No intervention	61 (54.5%)
Scores (median, interquantile range)	
Glasgow-Blatchford score [5]	9 (5)
Pre-endoscopy Rockall [3]	2 (2)
Complete Rockall score [3]	4 (4)
AIMS-65 [6]	1 (2)
ABC [7]	3 (4)

[Table/Fig-1]: Characteristics of patients, treatment, and outcome (N=112).

On endoscopy the most common cause of AUGIB among the study group was variceal bleed (39.3%) followed by peptic ulcer bleed (25.9%) and erosive bleed (16.1%) [Table/Fig-2]. No signs of recent bleed were noted in 8.9% of the study population on endoscopy [Table/Fig-2]. A total of 54.5% required no therapeutic intervention either endoscopically or surgically, 44.6% were managed with endoscopic treatment and only one patient (0.9%) underwent surgical treatment for the bleed.
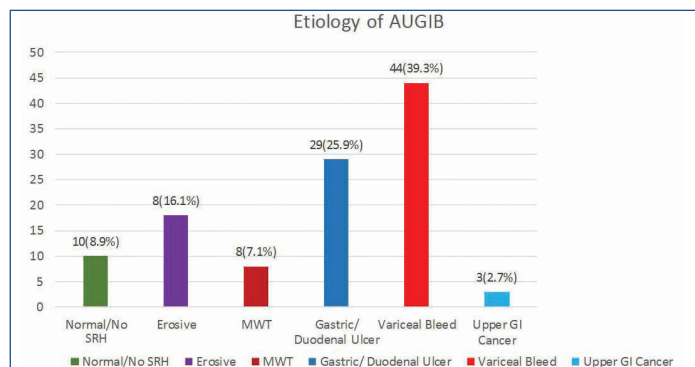
[Table/Fig-2]: Endoscopic findings in study population (N=112).

On analysis of the laboratory parameters, we found that low systolic BP, tachycardia, high Blood Urea Nitrogen (BUN), low albumin and raised INR on presentation are all predictors of in-hospital mortality [Table/Fig-3].

Parameters	Recovered (n=101) (Mean±SD)	Mortality (n=11) (Mean±SD)	p-value
Systolic blood pressure (mmhg)	113.58±17.45	84.55±24.23	0.001*
Heart rate (beats/min)	91.99±13.26	107.45±21.67	0.001*
Haemoglobin (g/dL)	10.04±3.33	9.24±2.14	0.435
Blood urea (mmol/L)	8.23±6.12	12.46±7.31	0.024*
Serum creatinine (mg/dL)	1.10±1.25	1.44±0.93	0.377
Albumin (g/dL)	3.245±0.69	2.35±0.33	0.001*
International normalised ratio	1.34±0.47	1.85±0.57	0.014*

[Table/Fig-3]: Predictors of in hospital mortality.
*p-value <0.05 was considered as statistically significant; Paired t-test used

When comparing variceal and non variceal upper GI bleed, variceal bleed showed a greater mortality risk (18.2% vs 4.4%) and overall intervention requirement in the form of blood transfusions and endoscopic therapy [Table/Fig-4].

| Parameters	Non variceal bleed (n, %)	Variceal bleed (n, %)
Blood transfusion	19 (27.9)	13 (29.54)
Endoscopic therapy	11 (16.2)	39 (88.6)
Surgery	1 (1.5)	0
Mortality	3 (4.4)	8 (18.2)

[Table/Fig-4]: Comparison of clinical outcomes between non variceal (n=68) and variceal bleed (n=44).

AIMS-65 score showed good discriminative ability for the prediction of in-hospital mortality overall (AUROC 0.908). Based on AUROCs, AIMS-65 score was better at predicting in-hospital mortality, as compared with Rockall score (AUROC=0.894, p-value=0.001), GBS score (AUROC=0.818, p-value=0.001), ABC score (AUROC=0.778, p-value=0.003) and pre-endoscopy Rockall score (AUROC=0.756, p-value=0.005) [Table/Fig-5,6].

On subgroup analysis comparing non variceal and variceal bleed, Complete Rockall score performed better than all other scores in predicting in hospital mortality in non variceal bleeds (AUROC=0.908) p-value=0.018 compared to AIMS-65 (AUROC=0.895) p-value=0.021, ABC (AUROC=0.838) p-value=0.049, GBS (AUROC=0.718) not significant and Pre Endoscopy Rockall (AUROC=0.715) not significant [Table/Fig-7,8].

| Risk score	AUROC (95% CI)	Standard error	p-value
GBS	0.818 (0.71-0.93)	0.055	<0.001**
Pre-endoscopy Rockall	0.756 (0.63-0.89)	0.066	0.005*
Rockall	0.894 (0.82-0.97)	0.040	<0.001**
AIMS-65	0.908 (0.85-0.97)	0.032	<0.001**
ABC	0.778 (0.65-0.90)	0.064	0.003*

[Table/Fig-5]: Comparison of Area Under Receiver Operator Characteristic (AUROC) curve of risk scores in prediction of mortality.
*p-value <0.05 was considered as statistically significant and **p-value <0.001 as highly significant
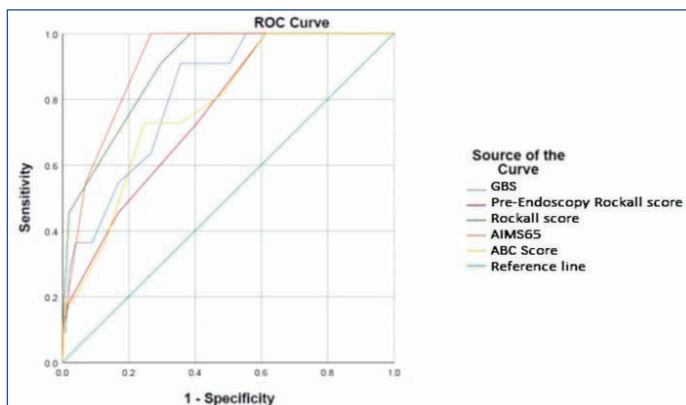
[Table/Fig-6]: ROC Curve comparing risk scores in predicting mortality overall.

Risk score	AUROC	Standard error	p-value
GBS	0.718	0.117	0.204
Pre-endoscopy Rockall	0.715	0.102	0.210
Rockall	0.908	0.044	0.018*
AIMS-65	0.895	0.047	0.021*
ABC	0.838	0.120	0.049*

[Table/Fig-7]: Comparison of AUROC# of risk scores in non variceal Bleed in prediction of mortality.
AUROC: Area under receiver operator characteristic curve; p-value <0.05 was considered as statistically significant
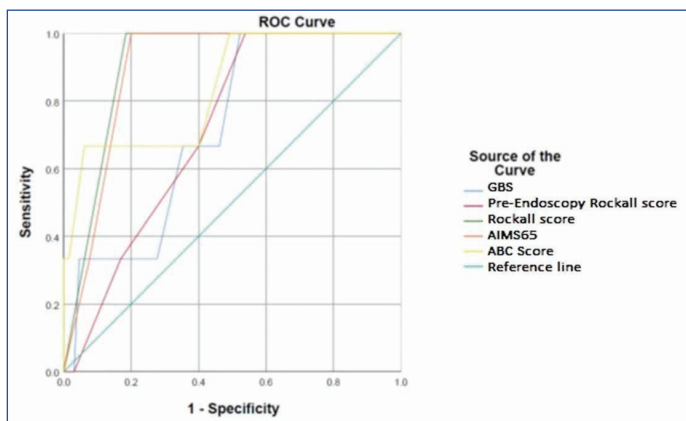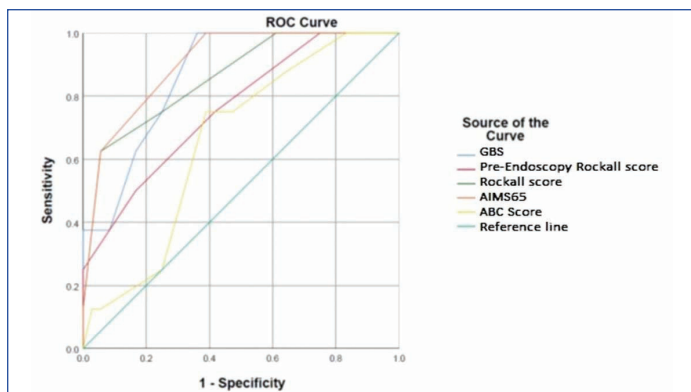

[Table/Fig-8]: ROC Curve comparing risk scores in predicting mortality in non variceal bleed.

Among variceal bleeds AIMS-65 (AUROC 0.903) p-value <0.001 performed better than GBS (AUROC 0.866) p-value <0.001, Complete Rockall score (AUROC=0.859) p-value=0.002, Pre-endoscopy Rockall (AUROC=0.760) p-value=0.022 and ABC (AUROC=0.658) not significant [Table/Fig-9,10].

DISCUSSION

The guidelines recommend the use of risk scores to stratify patients presenting with AUGIB to determine priorities and identify high risk patients who require aggressive resuscitation and appropriate intervention, in order to minimise morbidity and mortality [18,19]. The accuracies of GBS, Rockall and AIMS-65 scores in predicting outcomes or need for interventions were supported by various previous studies [20-23]. In the present study we compared

[Table/Fig-9]: ROC Curve comparing risk scores in predicting mortality in variceal bleed.

Risk score	AUROC	Standard error	p-value
GBS	0.866	0.058	0.001*
Pre-endoscopy Rockall	0.760	0.093	0.022*
Rockall	0.859	0.072	0.002*
AIMS-65	0.903	0.051	0.001*
ABC	0.658	0.094	0.116

[Table/Fig-10]: Comparison of Area Under Receiver Operator Characteristic (AUROC) curve of risk scores in variceal bleed in prediction of mortality.
*p-value <0.05 was considered as statistically significant

commonly used upper GI bleed risk scores along with the recently proposed ABC score which also took into account co-morbidity status along with laboratory parameters [7].

In the present study all risk scores were found to be accurate tools for predicting in-hospital mortality and AIMS-65 excelled over other risk scores in predicting the same. The ABC score study by Laursen SB et al., which was proposed as a single score to risk stratify patients with both upper and lower gastrointestinal bleed in contrary to our study found that it scored over AIMS-65 in predicting mortality (AUROC 0.86 vs 0.65) [7]. The present study was different from the ABC study done by Laursen SB et al., in few aspects, ABC study included patients who presented to ER with upper GI bleed as well as in-patient gastrointestinal bleeds, and it considered 30 day mortality rather than in-hospital mortality [7]. Abourgergi SA et al., underlined the influence of length of follow-up on scores of mortality risk, found that AIMS-65 had AUROC for predicting in-hospital mortality of 0.85, but it dropped to 0.74 in predicting 30 day mortality, which matched values from another large international study from Stanley AJ et al., [8,22].

The studies from the west have reported that the most common cause of AUGIB is nonvariceal (86-93%) whereas data from Asia shows a higher prevalence of variceal bleed accounting for 16-40% of AUGIB [6,8,24-26]. Reed EA et al., and Thanapirom K et al., reported that both GBS and Rockall scores have poor outcome predictability in patients presenting with variceal AUGIB [24,27]. Variceal bleeding is mostly associated with massive bleeding and prognosis of patients is closely related to the severity of liver disease [26]. Components of AIMS-65 such as serum albumin and INR also reflect the baseline liver function of patients with chronic liver disease, which improved its accuracy in predicting outcomes in patients with variceal bleed which constituted around 40% of study population [28]. The present study population is similar to those reported from Southern, Northern and Western parts of India in which patient population is younger and variceal bleed constitutes >40% of the aetiology of AUGIB [11-15].

Primary outcome chosen in our study was in-hospital mortality, since two of the scores (Complete Rockall and AIMS-65) used in this study were developed and validated to predict in-hospital mortality [3,6]. The studies done previously from India that had evaluated risk scores in predicting mortality used different primary

outcome and hence had drawn different conclusions. Of those, three studies by Anchu AC et al., Sharma V et al., and Rout G et al., used composite endpoint of mortality, need for intervention and rebleed, whereas, Chandnani S et al., study used 30 day mortality and recently published Totagi A et al., used in-hospital mortality as the primary outcomes [11-15].

The study done by Anchu AC et al., which used composite endpoint concluded that GBS was better at overall risk stratification, but AIM65 score was not used in the study [11]. Sharma V et al., compared only Complete Rockall with Pre endoscopy Rockall and concluded Complete Rockall performed better, GBS and AIMS-65 were not compared in the study [12]. In the study by Chandnani S et al., which took 30 day mortality as primary outcome found Complete Rockall score better than GBS, AIMS-65 and Progetto Nazionale Emorragica Digestiva (PNED) score [14]. None of these studies included ABC score of Laursen SB et al., which included ASA category along with co-morbidities and was found to be superior to previously validated scores including AIMS-65 in predicting 30 day mortality in a large study cohort of 3012 patients [7]. The present study is unique in that aspect of considering all the major validated risk scores in predicting mortality in a study population with equal distribution of variceal and nonvariceal AUGIB.

Limitation(s)

There were a few limitations in the present study. Firstly, this was a retrospective analysis from a single centre with small study population. Secondly, the mortality in patients with non variceal bleed was 4.4% compared to 18.2% in variceal group, though which is similar to other Indian studies the factors predicting in-hospital mortality might have been skewed due to higher mortality in the variceal group. Third, authors did not follow-up the patients after discharge, so comparison with other studies which takes 30 day mortality is not possible. Fourth, authors did not assess various subgroups of non variceal and variceal bleeds based on Forrest classification or location of varices that have risk of re-bleeding and the modality of intervention these patient groups underwent that might have influenced the in-hospital mortality.

CONCLUSION(S)

A risk stratification score for upper GI bleed becomes ideal when it is easy to use in Emergency room with few parameters irrespective of etiology of bleed before taking up the patient for endoscopy. AIMS-65 which is a pre-endoscopy score, easily calculated at bedside with three clinical and two lab parameters in emergency room itself is useful on predicting in-hospital mortality in both variceal and nonvariceal etiology of AUGIB. The current study re-enforces the utility of this simple bedside score in faster triaging and predicting in-hospital mortality for better intensive care and interventions.

Declaration: The original paper titled "Comparison of risk scores for predicting in-hospital mortality in patients presenting with acute upper gastrointestinal bleed" has not been published anywhere. Only the abstract has been published in the Indian Journal of Gastroenterology 2020, 39(Supplement 1) Abstract # 306 p97, as I (Dr. Damodar Krishnan) had presented this study as an e-poster at 61st Indian society of Gastroenterology (Virtual Diamond Jubilee ISGCON 2020) held on 19th to 20th December.

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