The Efficacy Of Heart Score In Prediction Of Major Adverse Cardiac Events In Patients Presenting With Undifferentiated Chest Pain In A Tertiary Care Centre

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Abstract :
Background : *Acute Coronary Syndrome (Acs) Refers To A Spectrum Of Diseases Occurring Due To An Abrupt Reduction In Blood Flow Through A Coronary Artery To A Cardiac Tissue. Clinical Presentations Vary According To The Degree Of Coronary Artery Occlusion And Subsequent Myocardial Ischaemia(1).Though Chest Pain Has A Diverse List Of Differential Diagnosis , It Is Essential That An Acute Coronary Syndrome Versus A Non-Cardiac Cause Be Differentiated. In A Setting Such As Casualty , A Quick, Evidence-Based Decision Is Necessary To Avoid A Missed Diagnosis Or Wrong Discharge Surrounding An Uncertain Aetiology For Chest Pain. A Prediction Tool, The Heart Score Was Developed To Help Emergency Physicians Risk-Stratify Chest Pain Patients Who Will Develop A Major Adverse Cardiac Event (Mace).*
Materials And Methods: *A Total Of 175 Patients Presented With Undifferentiated Chest Pain In Medicine Emergency Who Fulfilled The Inclusion Criteria Were Selected After Obtaining Consent. The Heart Score At The Time Of Presentation Was Calculated Efficacy Of The Score Was Studied And Optimum Cut Off Was Estimated Using Roc Curve .The Accuracy Of Heart Score In Prediction Of Major Adverse Cardiac Events Was Then Studied*
Results : *The Minimum Age Was 24 And Maximum Age Was 86 .Age Had A Statistically Significant Correlation With Major Adverse Cardiac Events With A P Value Of 0.041 . 28.9 % Of The Males And 31.8% Of Females Developed Major Adverse Cardiac Events In This Study. There Is No Statistically Significant Association Between Gender And Major Adverse Cardiac Events In This Population . P Value Was 0.679. , 30.3 % Of Study Population Had 1 Or More Major Adverse Cardiac Events , With 27.4% Had Ami , 4 % Each Had Undergone Pci And Cabg Respectively And 1.7 % Died Within Follow Up Period . The Mean Heart Score Of The Population Was 4.1± 2 . Median Was 4 .Optimum Cut Off Was 4 , With A Sensitivity , Specificity And Negative Predictive Value Calculated As 90.57 , 81.15 And 95.2 Respectively . With Increasing Value Of The Heart Score , Sensitivity Decreases , Specificity Increases And Negative Predictive Value Decreases . Area Under The Roc Curve Was Calculated As 0.939 With A P Value Of < 0.0001 .*
Conclusion : *The Heart Score Is Effective In Predicting Major Adverse Cardiac Events In Patients Presenting To Medical Emergency With Chest Pain.30.3 % Of Study Population Had 1 Or More Major Adverse Cardiac Events.The Mean Heart Score Of The Population Was 4.1± .Optimum Cut Off Was 4, With A Sensitivity , Specificity And Negative Predictive Value Calculated As 90.57 , 81.15 And 95.2 Respectively .Age Had A Statistically Significant Association With Major Adverse Cardiac Events. With Increasing Age, The Proportion Of Mace Increased Within The Study Population .There Is No Statistically Significant Association Between Gender And Major Adverse Cardiac Events In This Population .With Increasing Value Of The Heart Score , Sensitivity Decreases , Specificity Increases And Negative Predictive Value Decreases .The Heart Score Is A Simple , Fast And Accurate Predictor Of Major Adverse Cardiac Events In Patients Presenting With Undifferentiated Chest Pain .*
Key Word *:Heart Score ,Mace*

I. INTRODUCTION

Acute coronary syndrome (ACS) refers to a spectrum of diseases occurring due to an abrupt reduction in blood flow through a coronary artery to a cardiac tissue. Patients with ACS usually presents with a sudden onset of a constricting type of chest pain occurring at rest or with minimal exertion that may radiate to either or both arms, the neck, or jaw .Dyspnoea , dizziness, nausea, or profuse sweating may also occur. Clinical presentations vary according to the degree of coronary artery occlusion and subsequent myocardial ischaemia(1).

Though chest pain has a diverse list of differential diagnosis , it is essential that an acute coronary syndrome versus a non-cardiac cause be differentiated. In a setting such as casualty , a quick, evidence-based decision is necessary to avoid a missed diagnosis or wrong discharge surrounding an uncertain aetiology for chest pain. A prediction tool, the HEART score was developed to help emergency physicians risk-stratify chest pain patients who will develop a major adverse cardiac event (MACE). It is a scoring system that assigns 0-2 points on history, ECG, age, risk factors, and troponin, with each factor being weighed maximum 2 points(2) .

II. Material And Methods

Study Design : Prospective observational study

Study Setting : Casualty and medical ward, medical college Kottayam

Study Period: 12 Months from the period of IRB Approval

Study Population: Patients Presenting To Medicine Emergency With Chest Pain

Study Tool : Semi structured questionnaire, Ecg , lab reports and HEART Scoring Table

Sample Size : 175

Sample size calculation: According to the study 'Evaluation Efficacy of HEART Score in Prediction of Major Advanced Cardiac Events in Patients with Chest Pain' by BOLVARDI et al., Biosci, Biotech. Res. Asia,the prevalence of major adverse cardiac events is 24%. The sensitivity of the study when using 5 points as cut off was 87.5%.,D=absolute precision= 1,$Z\alpha^2$=3.84**.**
Sample size $N=Z\alpha^2$ sensitivity(1-sensitivity)÷(d²×prevalence)
$$=3.84\times87.5\times12.5\div(1\times24)$$
$$=175$$
Inclusion Criteria: Patients presenting to the medicine Casualty with undifferentiated chest pain more than18 years of age

Exclusion Criteria: Diagnosed case of MACE Referred from outside for intervention, partially treated cases referred from other hospitals, ST elevation myocardial infarction, Traumatic chest pain.

Procedure Methodology : After getting Institutional Review Board clearance and consent from patients, a prospective observational study was conducted on patients presented to the medicine Casualty Govt. medical college Kottayam during the period of 12 months from obtaining the Institutional Review board clearance. Detailed history was taken from the patient or reliable bystander for the assessment of disease status after an informed consent. Following this a clinical examination including general examination and system examination was done. The patients were subjected to ECG and troponin estimation. The proforma is filled and all lab values were collected and entered systematically. The HEART SCORE was calculated from the parameters obtained. Patient was followed up for outcome until discharge/death and after 1 week and 3 weeks after presentation through phone. The data's obtained was entered in Microsoft excel and these data were analyzed using SPSS software. During the analysis the patients were grouped depending on the outcome

Statistical Analysis : Data was entered in MS Excel and analyzed using SPSS software version 16. Quantitative data was analyzed as mean and standard deviation. Qualitative data was summarized as frequency and percentage. The predictive accuracy of heart score was measured as sensitivity, specificity, positive predictive value, negative predictive value and a cut off was be found out using ROC curve. Association of various factors were assessed using appropriate structural test like Chi-square test or t test. The significance was taken as a p value <0.05.

III. RESULTS

Among the patients presented with chest pain in the medicine emergency, Government Medical College Kottayam from May 29 2022, a total of 175 consecutive patients who met the inclusion criteria were enrolled in the study. HEART score at the time of presentation was calculated and its efficacy in prediction of major adverse cardiac events was studied

Table no 1 Distribution Of Major Adverse Cardiac Events Among Study Population

|	Frequency	Percent
DIAGNOSED AMI	48	27.4
UNDERWENT PCI	7	4
HAD CABG	7	4
DEATH	3	1.7
Total	175	100
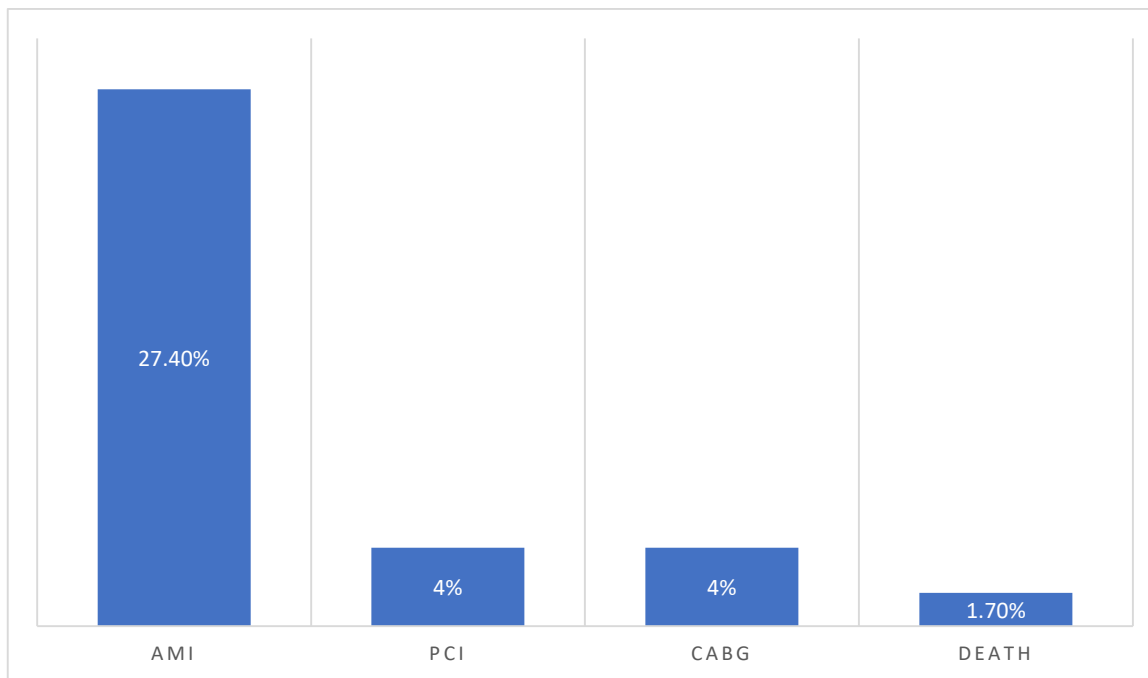
Graph 1 . Distribution of major adverse cardiac events in study population

Of the patients who had a major adverse cardiac event , 27.4 % were diagnosed to have AMI , 4 percent had undergone PCI ,45 had done CABG , and 1.7% had died .

Table no 2 Gender Distribution Of Major Adverse Cardiac Events

| Gender	Adverse Cardiac Events				Total		χ^2	df	P
	No		Yes						
	N	%	N	%	N	%			
Male	64	71.1	26	28.9	90	100	.171	1	0.679
Female	58	68.2	27	31.8	85	100			
Total	122	69.7	53	30.3	175	100			

In the study population , 28.9 % of the total 64 males and 31.8% of the 58 females developed major adverse cardiac events .There is no statistically significant association between gender and major adverse cardiac events in this population .
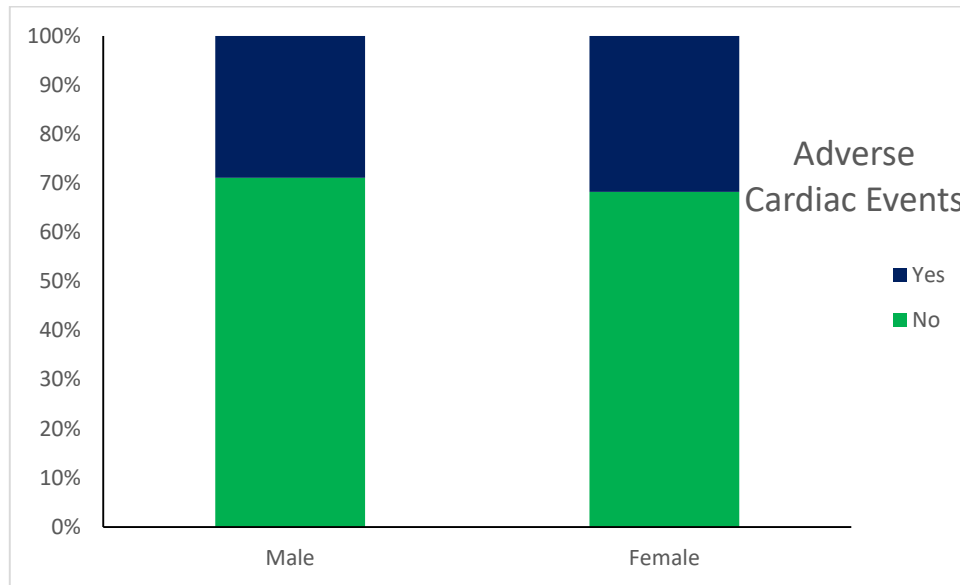
Graph 2. Gender distribution of MACE

Age	Adverse Cardiac Events				Total		χ²	df	P
	No		Yes						
	N	%	N	%	N	%			
>65	22	62.8	13	37.2	35	100			
45-65	68	66.0	35	34.0	103	100	6.375	2	0.041
<45	32	86.48	5	13.51	37	100			
Total	122	69.7	53	30.3	175	100			

Among the study population , 37.2% of the patients above 65 suffered a major adverse cardiac event , while 34% of the patients between 45 and 65 had a major adverse cardiac event .Only 13.5% of the patients below 45 years had a major adverse cardiac event.

There is a statistically significant association between age and major adverse cardiac event.
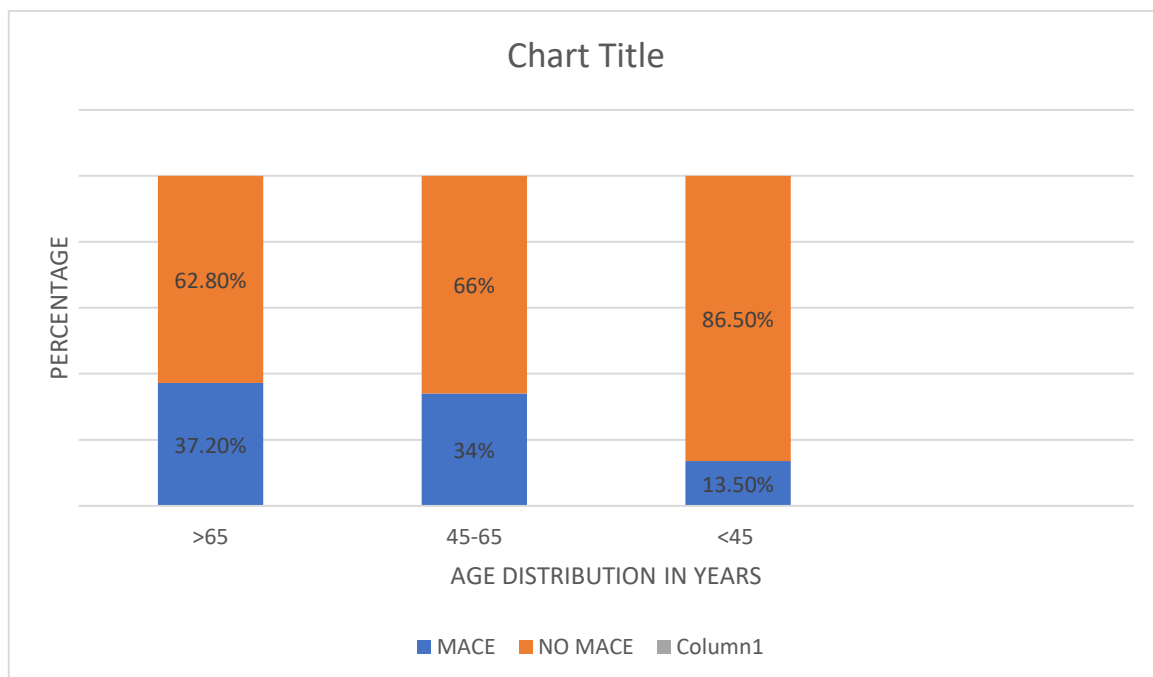

Graph 3. Distribution of MACE with respect to age

	Mean ±sd	range	Median	IQR
HEART SCORE	4.1± 2.0	0-9	4	3-5
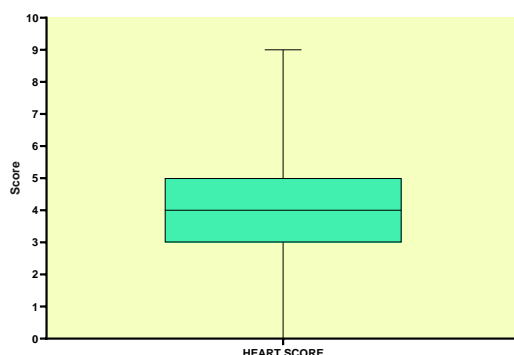
Graph 3 .Box plot diagram describing HEART SCORE. Lower and upper end of the whisker represents minimum and maximum score respectively. Lower border of the box represents 25th percentile and upper border of the box represents 75th percentile. Middle horizontal line represents median score

ROC curve of Heart score for predicting Adverse Cardiac Events
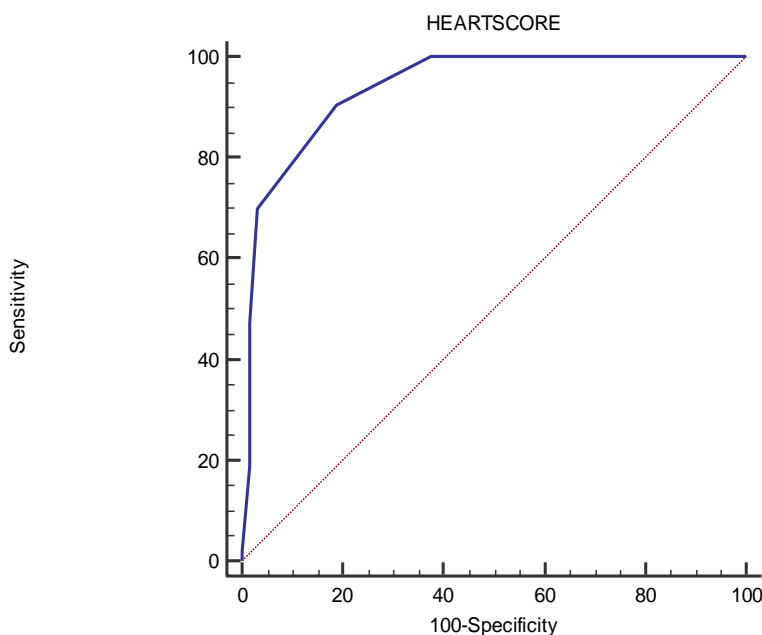
ROC curve of HEARTSCORE	
Classification variable	Adverse Cardiac Events
Positive group : Adverse Cardiac Events – Present	53
Negative group : Adverse Cardiac Events – Absent	122
Area under the ROC curve (AUC)	0.939
Standard Error	0.0168
95% Confidence interval	0.892 to 0.969
z statistic	26.161
P	<0.0001
Youden index J	0.7171
Optimum cut off	>4
Sensitivity	90.57
Specificity	81.15

HEART Score	Sensitivity	Specificity	+LR	-LR	+PV	-PV
>3	100	62.3	2.65	0	53.5	100
>4	90.57	81.15	4.8	0.12	67.6	95.2
>5	69.81	96.72	21.29	0.31	90.2	88.1
>6	47.17	98.36	28.77	0.54	92.6	81.1
>7	18.87	98.36	11.51	0.82	83.3	73.6

To evaluate sensitivity , predictive values and specificity ,of HEART score ,each of the points 3 , 4 ,5 6 and 7 were taken as cut off points .In cut-off point 3 , sensitivity ,specificity and negative predictive value were calculated as 100 , 62.3 and 100 respectively . In cut-off point 4 , sensitivity , specificity , positive predictive value and negative predictive value where 90.57 , 81.15 , 67.6 and 95.2 respectively .When cut off point was taken as 5, sensitivity was 69.81% , specificity was 96.72 positive predictive value was 90.2 and negative predictive value was 88.1 .

When cut-off point was 6 , sensitivity was 47.17, specificity was 98.36 , positive predictive value was 92.6 and negative predictive value was 81.1.In cut off point 7 , sensitivity, specificity, positive predictive value, and negative predictive value were 18.87, 98.36, 83.3, and 73.6 respectively. It is evident that , as the HEART score point increases sensitivity decrease, specificity increase and negative predictive value decreases .

IV . DISCUSSION

Among the patients presented with chest pain in the medicine emergency ,Government Medical College Kottayam from May 2022 , a total of 175 consecutive patients who met the inclusion criteria were enrolled in the study. History was evaluated and troponin sent and ECG taken at the time of presentation and HEART score at the time was calculated .The minimum age was 24 and maximum age was 86 .Age had a statistically significant correlation with major adverse cardiac events with a p value of 0.041 . 28.9 % of the males and 31.8% of females developed major adverse cardiac events in this study. There is no statistically significant association between gender and major adverse cardiac events in this population . P value was 0.679.

In a study conducted by Bolvardi et al., mean age of the included population was 60.85 .Age and troponins were independent risk factors in both genders in the study .21% of the males and 21.79% of females had one or other major adverse cardiac events at 30-day follow-up. There was no statistically significant difference in outcome in both genders .

In this study , 30.3 % of study population had 1 or more major adverse cardiac events , with 27.4% had AMI , 4 % each had undergone PCI and CABG respectively and 1.7 % died within follow up period .

	MACE	MEAN AGE	P VALUE (AGE)	P VALUE (GENDER)
Bolvardi et al.	24%	60.85±14.09	0.001	0.278
Current study	30.3%	56.6±14.64	0.041	0.679

The mean HEART score of the population was 4.1± 2 . Median was 4 .Optimum cut off was 4 , with a sensitivity , specificity and negative predictive value calculated as 90.57 , 81.15 and 95.2 respectively .In the study conducted by Bolvardi et al. 3 points and 5 points were taken as 2 different cut offs(59).
At cut off point 3

	Sensitivity	Specificity	PPV	NPV
Bolvardi et al.	100%	14.4%	26.9%	
Present study	100%	62.3%	53.5%	100%

At cut off point 5

	Sensitivity	Specificity	PPV	NPV
Bolvardi et al.	87.5%	47.3%	34.4%	
Present study	69.81%	96.72%	90.2%	88.1%

This study shows that , with increasing value of the HEART score , sensitivity decreases , specificity increases and negative predictive value decreases. Area under the ROC curve was calculated as 0.939 with a p value of < 0.0001.In a study conducted by Six et al. (2008), it is shown that patient history, ECG and elevated troponin values (P<0.001) were independent predictors of MACE(60). In 2010 ,study conducted Backus et al also showed the above results(61) .

V.CONCLUSION

The HEART score is effective in predicting major adverse cardiac events in patients presenting to medical emergency with chest pain .30.3 % of study population had 1 or more major adverse cardiac events.The mean HEART score of the population was 4.1 ± 2.Optimum cut off was 4, with a sensitivity , specificity and negative predictive value calculated as 90.57 , 81.15 and 95.2 respectively .Age had a statistically significant association with Major adverse cardiac events. With increasing age, the proportion of MACE increased within the study population .There is no statistically significant association between gender and major adverse cardiac events in this population .With increasing value of the HEART score , sensitivity decreases , specificity increases and negative predictive value decreases .

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