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Research article

USES OF LOGISTIC REGRESSION TO PREDICT THE PROGNOSIS IN ACUTE MYOCARDIAL INFARCTION (AMI)

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ABSTRACT

Background: Logistic Regression is one of the important methods to perform the statistical model (s) in epidemiological & medical research. It allows the investigators to examine the relationship between binary dependent variable and a set of continuous & discrete independent variables. To understand utility & applicability of this method it was decided to study in hospital outcome (survival & death) of cases admitted due to AMI.

Objectives: To develop the prognostic model & compare the result of bivariate and multivariate analysis.
Study Design: Retrospective Record based study
Study Period: 31ST March 2011 to 1st January 2010.
Sample Size: 152 AMI Patients
Statistical Analysis: Bivariate analysis, to assess the role of each variable on the outcome variable death or survival chi square test was used. Logistic regression analysis was perform to find the set of best prognostic variable. Odds ratio was obtain by both methods to compare the role of covariates in prognosis of the outcome variable.
Result: Logistic Regression Analysis identified age, sex & resident have not shown association with prognosis, time gap in initiation of treatment, & length of hospital stay as most significant variables in the prediction of prognosis after AMI.

Conclusion: Logistic regression has failed to fit the data& unable to explain the contribution of explainary variables to the expected level. Hence further investigation is needed before making any final comments on its application.

Keywords: AMI, Prognoses, Logistic Regression, chi square test

INTRODUCTION

Logistic Regression is one of the epidemic logical and medical researches. It is a model used for prediction of the probability of occurrence of an event. It makes use of several predictor variable that may be either numerical or categories. Logistic Regression can be used to predict a dependent variable on the basis of continuous and/or categorical independents and to determine the percent of variance in the independent variable explained by independents; to rank the relative importance of independents/ to assess interaction effects; and to understand the impact of covariate control variable. Hence this study was undertaken to understand the utility and applicability of Logistic Regression in hospital outcome (survived and death) of patients admitted with diagnosis of Acute Myocardial infarction (AMI).

In India the prevalence of cardiovascular disease 65.4 to 47.8/1000 population. [1] Cardiovascular diseases is rapidly increasing in India and other developing countries[(2)] Cause specific mortality data indicates that the cardiovascular disease is an important contribute to mortality [3].

A steady decline in the mortality rate from AMI has been observed since 1960. Although its development is still a fatal event in one third of patients. AMI causes death or disability in many. Its personal and social costs are profound, both for individuals and families involved and for the countries in which it is common [(4).] Hence in the study the attempt has been made to generate the model determining in hospital prognosis after AMI.

MATERIAL AND METHODS

The patients admitted with AMI irrespective of demographic and risk variables- age, sex, place of residence, time of onset of disease, symptoms, time elapsed for initiation of treatment, hospital stay, presence and absence of diabetes, hypertension, cardiovascular disease, habits and hospital discharge status (survival or died) were collected from records in BLDEU'S Shri B.M.Patil Medical college Bijapur. The AMI patients with co-morbidity like renal failure, pneumonia, neurological disease, jaundice, acute gastroenteritis etc were excluded from the study because of insufficient data to draw invalid conclusions. Thus 152 cases were collected from records.

Statistical Analyses

The Bivariate analyses was used to understand the role of each variable on the outcome variable Survived and died. The differences were tested using chi square test. Odds ratio were applied to compare the role of covariates in prognoses of the outcome variables, the same data set was used for the validation of the Logistic regression model.

RESULTS

Out of 152 AMI. Patients 14 (9%) death occurred during treatment of AMI. Number of died cases 14 (9%) were analyzed with respect to age, sex, place of residence, time elapsed in treatment, hospital stay period, habit of smoking and alcoholism and history of cardiovascular disease, hypertension and diabetes.

Table I reveals that the variables age, sex and place of residence had no association (P>0.05) with prognosis. Hospital stay period was statistically associated with outcome of hospital (P=0.000) i.e. survived and death. It was observed that there were more deaths (i.e. 22% and 25%) who took treatment between 6 to 24 hours but the patients who took treatment between 0 to 6 hours their survival is high (96%). The increased period of stay in hospital for medi-core increased survival significantly (P<0.000).

Table 2 shows the bivariate analysis of finding the risk factors of AMI like the history of CVD, (Cardiovascular disease), Diabetes and Hypertension in past failed in proving association with prognosis. It was observed that the presence of diabetes and hypertension increased the risk of mortality 1.22 and 1.0 times. The unusual results of high mortality among non smokers and non alcoholism were observed and the same result observed in previous study also[4].

Table No.1: Beveritage Analysis

Var.s	Total	Survived	Died	OR(95%CI)	Chi sq test
Age					
<50®	36(24)	31(86)	5(14)	1.00	
50-70	83(54)	79(95)	4(5)	0.31(0.15-.626)	4.249 P=0.119
>70	33(22)	28(85)	5(15)	1.11(0.69-1.79)	
Sex					
Male®	107(70)	96(90)	11(11)	1.00	
Female	45(30)	42(93)	3(7)	0.61(0.37-1.04)	
Place of Residence					
Rural	115(76)	106(92)	9(8)	1.00	
Urban	37(20)	32(86)	5 (14)	1.89(1.23-2.87)	1.08 P=0.298
Time elapsed in Treatment (hrs)					
0-6 ®	69 (45)	66 (96)	3 (4)	1.00	
6-12	18 (45)	14 (70)	4 (22)	7.3 (3.98-13.39)	9.348 P=0.025
12-24	12 (30)	09 (70)	3 (32)	11.2(5.94-21.28)	
24+	53 (35)	49 (92)	4 (8)	0.47(0.258-0.846)	
Hospital Stay (Days)					
1-2	24 (16)	15 (64)	06 (36)	20.63(11.45-37.16)	
2-4	32 (21)	29 (91)	3 (9)	4.9 (2.52-9.51)	15.16 P = 0.001
4+®	96 (63)	93 (97)	3 (3)	1.00	

Table 3 is the results obtained from logistic Regression Model. It was found that all collected variables expect diabetic are statistically insignificant (P>0.05). The conclusion by bivariate analysis and logistic regressions were almost same (Table 3 vs Table 1). By regression model, only one risk factor i.e. diabetic showed statistically association with the outcome of hospital i.e. death and survival. But by bivariate analysis no association was found between diabetes and prognosis.

Table –2: Bivariate Analysis of Risk Variables

VARIABLES	SUBJECTS	SURVIVED	DIED	OR (95% C.I.)	Chi Sq test
Cvd in Past					
No History ®	93 (61)	86 (92)	07 (8)	1.00	2,554 P >0.05
History	56 (37)	50 (89)	06 (11)	1.45 (0.96-2.)	
NA	03 (2)	2 (67)	1 (33)	5.92 (2.37-14.68)	
NA – Information not available					
Diabetes ®					
Absent	121(80)	110(91)	11(9)	1.16	0.01
Present	31(20)	28(90)	3(10)	0.714-1.884)	P=0.920
Hypertension					
Absent	106(70)	96 (90)	10 (10)	0.923	0.021
Present	46 (30)	42 (91)	4 (9)	(.594-1.432)	P= 0.885
Smoking					
Non Smoker	68 (45)	58 (85)	10(15)	4.72-8.40)	9.64
Smoker ®	57 (38)	55(96)	2 (4)	1.00	P=0.02
Tobacco	16 (10)	15 (94)	01(6)	1.93 (0.79-4.71)	
Smoke + Tobacco	11(7)	10 (91)	1 (9)	2.84 (1.153-6.992)	
Alcoholism					
No	104 (68)	94 (90)	10 (10)	1.43 (0.809-2.525)	U-4.47
Occasional ®	29 (19)	27(93)	2 (7)	1.00	P=0.800
Chronic	19 (13)	17 (89)	2 (11)	1.5 3(0.729-3.21)	

Table 3: Logistic Regression Model for Prognosis as Death

Variables	B	S.E	Wald	df	sign	OR (95% CI)
Age	-0.011	0.022	0.278	1	0.598	0.989(0.948-1.03)
Sex	-1.116	0.881	1.607	1	0.205	0.327(0.058-1.84)
Place of residence	0.427	0.742	0.330	1	0.565	1.532(0.358-6.56)
Time-Elapsed	0..14	0.027	0.257	1	0.612	1.014(0.962-.068)
Hospital Stay	-0.05	0.073	0.473	1	0.492	0.951(0.824-1.09)
CVD in past	0.328	0.584	0.315	1	0.575	1.388(0.44-4.36)
Diabetic	0.054	0.926	0.003	1	0.953	1.056(0.17-6.48)
Hypertension	0.198	0.711	0.078	1	0.780	0.820(0.20-3.30)
Smoking	-1.96	0.811	5.849	1	0.016	0.141(0.03-0.69)
Hypertension	0.540	0.346	2.436	1	0.119	1.716(0.87-3.38)
constant	0.761	1.457	0.273	1	0.601	0.467

DISCUSSION

Because of early treatment (i.e within 6 hours) and increased period of hospital stay for the treatment, the mortality of AMI was very less (9%) as compared to the other studies conducted by[4,5] So the hospital stay period was most significant prognostic factor influencing the outcome and also early treatment of patients reduces the mortality.

Urban residents were at higher risk of death after AMI as compared to rural residence with odds ratio 1.5 may be due to urban life style. Similar results found in the study conducted by.[4,6]

In the present study we found that males were high risk of death after AMI as compared to females. Same result was observed when compared with other study [6]. But in some studies it was found that females are at high risk of death as compared to males [4, 7, 8]. This indicates that inclusion of gender in prognostic model may give improper prognosis.

As age increased the mortality of AMI increased (15%) with odds ratio 1.1 times as compared to age less than 70 years. But we got improper prognosis by applying logistic regression. The unusual results of high mortality among non smokers and non alcoholism were observed in the study. The same results were obtained in other study conducted by [4].

CONCLUSION

Bivariate analysis concludes that the early diagnosis and early treatment of the AMI patients reduces the high mortality, due to the timely medical care.

In most of the studies logistic regression has been applied to the same kind of data and claimed that it fits well to the data and explains in a better way. However this is the case where Logistic Regression has failed to fit the data and unable to explain the contribution of explainary variables to the expected level as it has happened in other cases. Hence further investigation is needed before making any final comments on its application.

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