

# Risk Assessment of Sudden Cardiac Death in Patients with Atrial Fibrillation Using CHA<sub>2</sub>DS<sub>2</sub>-Vasc Score

Manoj Shrestha,<sup>1</sup> Bibek Luitel<sup>2</sup>

<sup>1</sup>Department of Cardiology, <sup>2</sup>Department of Internal Medicine, Collage of Medical Sciences, Bharatpur, Chitwan, Nepal.

## ABSTRACT

### Introduction

Probability of sudden cardiac death is more in patient with atrial fibrillation than those without this condition. CHA<sub>2</sub>DS<sub>2</sub>-VASC score can be useful to predict the likelihood of sudden cardiac death among the patients with atrial fibrillation. The current study aims to evaluate the diagnostic value of the CHA<sub>2</sub>DS<sub>2</sub>-VASC score in anticipating sudden cardiac death among admitted patients with atrial fibrillation.

### Methods

The study was conducted for three months i.e. from 16th May 2023 till 17th August 2023. 150 patients fulfilling inclusion criteria were taken. Patient details, ECG features and risk factors were evaluated. CHA<sub>2</sub>DS<sub>2</sub>-VASC score was determined and the findings were analyzed statistically.

### Results

The study population constituted 60% males and 40% female with mean age of 58.9±10.99. The mean CHA<sub>2</sub>DS<sub>2</sub>-VASC score was 3.2±2.8. 25.3% of patients with atrial fibrillation had sudden cardiac death. For prediction of sudden cardiac death, CHA<sub>2</sub>DS<sub>2</sub>-VASC score had a sensitivity of 78.3%, specificity of 82.3%, positive predictive value of 59.1%, negative predictive value 92% and a diagnostic accuracy of 81.3% for predicting risk of sudden cardiac death.

### Conclusions

The diagnostic accuracy of the CHA<sub>2</sub>DS<sub>2</sub>-VASC score was 81.3% among patients having atrial fibrillation for predicting sudden cardiac death, making it an effective predictor.

**Keywords:** atrial fibrillation; sudden cardiac death; cha<sub>2</sub>ds<sub>2</sub>-vasc score.

**Correspondence:** Dr. Manoj Shrestha, Department of Cardiology, Collage of Medical Sciences, Bharatpur, Chitwan, Nepal.  
Email: drmanozshrestha@gmail.com. Phone: +977-9861901943.

## INTRODUCTION

Atrial Fibrillation (AF) is the commonest cardiac rhythm abnormality leading to dysrhythmia related hospitalization. Different studies have pointed out that atrial fibrillation imposes increased risk of sudden cardiac death. Atrial fibrillation can compromise the quality of life and can cause strokes and death. Obesity, Diabetes, Hypertension, elderly age and thyroid disorders can all increase the risk of atrial fibrillation which can pose significant burden to health care system.<sup>1,2</sup> Mortality due to sudden cardiac death and ventricular arrhythmias is more in patients with atrial fibrillation.<sup>1-6</sup> In one study there is 0.98 percent increased risk of sudden cardiac death and ventricular arrhythmias associated with atrial fibrillation.<sup>3</sup> Even though studies show about 22 percent incidence of sudden cardiac death in patients with atrial fibrillation, the basis of prediction is still not clear.<sup>3</sup> Based on different studies, the CHA2DS2-VASc score can be helpful to predict the risk of sudden cardiac death among people with atrial fibrillation. This score includes the patient's age (between 65 and 74 years old), congestive heart failure, hypertension, diabetes mellitus, a history of stroke or transient ischemic attack or thromboembolism, vascular disease, and female sex.<sup>4</sup> Different researches have been conducted to evaluate the association between higher CHA2DS2VASC score and risk of sudden cardiac death.<sup>1</sup> Those studies varified that CHA2DS2VASC score can be used to anticipate sudden cardiac death among admitted patients with atrial fibrillation.<sup>1</sup> This scoring system is regarded as the convenient, efficient and easier tool for assessment of unexpected death among atrial fibrillation patients. The higher the CHA2DS2VASC score greater the risk of thromboembolic phenomenon and sudden cardiac death.<sup>3</sup> CHA2DS2VASC score more than or equal to two means patients need to

take anticoagulant to prevent thromboembolic complications.<sup>5</sup> CHA2DS2VASC score higher than two is associated with unexpected cardiovascular mortality with 61% or sensitivity and 74% of specificity.<sup>7</sup> Lots of studies have been conducted internationally to determine the correlation between CHA2DS2VASC score and unexpected cardiac mortality among admitted atrial fibrillation patients. However in our country Nepal none of such studies have been conducted. The motto of this study is to bring in light the easy to use tool, CHA2DS2VASC scoring system in assessment of sudden cardiac risk among atrial fibrillation patients. It will bring to light the key risk factors that can be related with sudden cardiac death, the determination of which will aid us in reducing the morbidity and mortality associated with this illness by enabling us to deliver early therapies.

## METHODS

The study was conducted within 3 months from 16<sup>th</sup> May 2023 till 17 August 2023. An informed consent was taken from all the patients and their attendants. Both male and female patients aged between 40-80 years and with atrial fibrillation were included in the study and those patients who refused to participate or who didn't get admitted to the hospital were excluded. Sample size of the study was calculated using standard WHO sample size calculator with 150 patients within 95% confidence level and 13% margin of error. All the Demographic information, ECG findings and variables of CHA2DS2-VASc score were considered and noted. Electrocardiogram (ECG) was used to diagnose atrial fibrillation. ECG features to diagnose atrial fibrillation include: Irregular QRS complexes and absence of P waves. Risk of sudden cardiac death was evaluated by calculating the CHA2DS2-VASc score. CHA2DS2-VASc score is cumulative score comprised of: 1. Congestive Cardiac failure-1 score 2. Hypertension- 1 score 3. Age > 72 Years-

2 score 4. Diabetes- 1 score 5. Presence of stroke- 2 score 6. Vascular diseases- 1 score 7. Age > 65 – 1 score 8. Female sex- 1 score. The more the score, the higher the risk for sudden cardiac death and lower score means lower risk. Total score was 10 and the value more than 2 was taken as high score.

True positive: when CHA2DS2-VASc score was >2 and sudden death was present.

True negative: when CHA2DS2-VASc score was <2 and sudden death was absent.

False positive: when CHA2DS2-VASc score was >2 and sudden death was absent.

False negative: when CHA2DS2-VASc score was <2 and sudden death was present.

Sudden cardiac death was defined as death occurring due to cardiac arrhythmias during hospitalization. Data was analyzed by using SPSS 17. The quantitative variables included age and CHA2DS2-VASc score. These variables were presented by mean and standard deviation. Other qualitative variables like sex and sudden cardiac death were presented by frequency.  $P \leq 0.05$  was considered significant. The predictive accuracy of the CHA2DS2-VASc scores was determined by comparing it with the gold standard value. The specificity, sensitivity, positive predictive value and negative predictive value was determined.

## RESULTS

Total 150 patients participated in this study. The mean age of the patients was 58.9 years with

10.9 years of standard deviation. The average CHA2DS2-VASc score was 3.2 with standard deviation of 2.8. 60% of the study population were males and 40% were females (Table 1).

Gender	Frequency (%)
Male	90(60)
Female	60(40)

Also, 25.3% of patients with atrial fibrillation had sudden cardiac death during hospitalization. The CHA2DS2-VASc score has a diagnostic accuracy of 81.3%, a sensitivity of 78.3%, a specificity of 82.3%, a positive predictive value (PPV) of 59.1%, a negative predictive value (NPV) of 92% (Table 2).

Sudden cardiac death	Frequency (%)
Yes	38(25.3)
No	112(74.6)

Following formulas were used to calculate the accuracy:

$$\text{Sensitivity} = \text{TP} / (\text{TP} + \text{FN}) = 78.3\%$$

$$\text{Specificity} = \text{TN} / (\text{TN} + \text{FP}) = 82.3\%$$

$$\text{PPV} = \text{TP} / (\text{TP} + \text{FP}) = 59.1\%$$

$$\text{NPV} = \text{TN} / (\text{FN} + \text{TN}) = 92\%$$

$$\text{Diagnostic accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FP} + \text{FN}} \times 100 = 81.3\%$$

Sudden Cardiac Death On Cha2ds2-Vasc Score	Sudden Cardiac Death During Hospitalization	
	Yes	No
Yes	True Positive (TP) 29 cases 19.30%	False Positive (FP) 20 cases 13.30%
No	False Negative (FN) 8 cases 5.30%	True Negative (TN) 93 cases 62%

## DISCUSSION

There are many contributing factors of sudden cardiac death in patients with atrial fibrillation. Those factors include past history of cerebrovascular accident, hypertension, diabetes, obesity, sex, age and socio-economic factors.<sup>1</sup> The occurrence of ventricular arrhythmias are high risk factor causing devastating sudden cardiac death among the patients with atrial fibrillation.<sup>1</sup> Kuo L in 2018 carried out the study which proposed the use of CHA2DS2-VASc score to estimate the risk of sudden cardiac death among the patients with atrial fibrillation.<sup>1</sup> The researchers studied total 288,181 patients with atrial fibrillation and they found that during the time of follow up sudden cardiac death occurred among 11,166 of them. This study was gleaned from that research. In that study the patients with CHA2DS2-VASc score of 0 had 0.3% risk of sudden cardiac death while those with the score of 9 had 2.63% risk of sudden cardiac death. This study clearly showed that- higher the CHA2DS2-VASc score the more is the risk of sudden cardiac death among the patients with atrial fibrillation. The conclusion of this study also correlated with our study. Our study also found out that the higher CHA2DS2-VASc score is the strong predictive factor for sudden cardiac death among the patients with atrial fibrillation. Another study in 2017 by Chao T.F. compared the risk of sudden cardiac death between the patients with atrial fibrillation and patients without it. He also tried to find other factors contributing to sudden cardiac death among the patients with atrial fibrillation. He found that the incidence of sudden cardiac death was higher among the patients with atrial fibrillation as compared to those without it i.e. 0.97%

death incidence in atrial fibrillation patients as compared to 0.97% among the patients without it.<sup>2</sup> Different risk factors are found to be responsible for sudden cardiac death. Contributing factors include chronic lungs disease, chronic kidney disease, vascular disorders, hypertension, diabetes, cardiac failure and age more than 75 years. It was found that atrial fibrillation patients had 1.64 times higher risk of sudden cardiac death as compared to who did not have it.<sup>8</sup> These results are comparable to this study which also revealed higher incidence of sudden cardiac death in patients with atrial fibrillation which is 25.3%. Our study has limitations as well. This is single centered study. So any generalization of the result may be difficult. Plus, below 40 years age group was not included in this study which makes it inappropriate to generalize the findings among younger age group patients. Also patients with severe illness were also excluded from this study which is generally done in bigger trails. In conclusion, our study consisted of a straightforward assessment of the baseline at a single moment in time, which may not accurately reflect the condition of the patient over extended periods of time.

## CONCLUSIONS

Diagnostic value of higher CHA2DS2-VASC score in predicting sudden cardiac death among atrial fibrillation patients is very good. The high predictive value of this score was significantly related to obesity, age, sex, diabetes, hypertension, previous history of stroke and socio-economic status. CHA2DS2-VASC score can be used in clinical practice to assess the risk sudden cardiac death among the patients with atrial fibrillation with high predictive value.

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