

PRE OPERATIVE PREDICTION OF POST CORONARY ARTERY BYPASS GRAFTING ATRIAL FIBRILLATION

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SUMMARY

We retrospectively analyzed 146 consecutive patients who underwent first time coronary artery bypass grafting (CABG) with a view to find predictors for preoperative predictions for atrial fibrillation. Forty-one out of them went into atrial fibrillation. Preoperative p-wave duration in V1, which represents prolonged atrial conduction was the only statistically significant independent predictor of atrial fibrillation after CABG. On step wise logistic regression analysis (p value < 0.01). The probability of developing atrial fibrillation post operatively increased with increasing p-wave duration. We conclude that this model can be used to identify a sub-group of patients at high risk of developing atrial fibrillation post CABG.

INTRODUCTION

Atrial Fibrillation is the commonest arrhythmia in man¹ and is also the commonest complication after coronary artery bypass grafting. It's incidence has been quoted between 10% and 40%^{2,3} in various series. The exact etiology of this arrhythmia is unknown, but various factors namely surgical trauma, inadequate atrial protection, cooling, electrolyte abnormalities and myocardial ischemia have been shown to predispose it. It was thought to be a benign transient self limiting event, but now a number of studies have shown that atrial fibrillation is not benign. It leads to an increase in early and late surgical mortality². (Atrial fibrillation also increases the pre operative stroke and myocardial infarction rate thus leading to longer hospital stays and driving up the cost of care)². This has led to a renewed interest in its prevention and treatment. The aim of our study was to identify predictors for pre operative predictions of atrial fibrillation after coronary artery bypass grafting.

METHOD

We retrospectively analyzed 146 consecutive patients undergoing first time coronary artery bypass grafting by reviewing their case notes in detail. Patients with a pre operative history of arrhythmia and permanent pacemakers implanted were excluded. Also excluded were patients who had re-do surgery or concomitant bypass surgery. The mean age of the group was 63.9 years with a range of 39 to 82 years. The male to female ratio was 3:1. The variables analyzed were age, sex, severity of disease, number of grafts, L.V. functions, category of operations, pre operative diuretics, pre operative beta blockers, pre operative heart rates, pre operative p-wave duration in lead V1, pre operative P-R interval in V1, post operative p-wave duration in V1 and post operative P-R intervals in V1. The ECG parameters were rechecked by blinded observers to remove bias.

STATISTICAL ANALYSIS

All variables were analyzed by step-wise logistic regression. Computer software used was S.P.S.S. A p-value of < 0.05 was considered significant. The probability of developing atrial fibrillation was calculated and then the sensitivity, specificity, positive and negative predictive values were determined.

RESULT

Forty one out of the 146 patients went into atrial fibrillation, which was 28% of the group. The mean age of this sub group was 64.5 years (45-82 years). The male to female ratio was 7:1. We had no early major complications like in-hospital deaths or cardiovascular events in this group. The episode of atrial fibrillation most commonly occurred on the second or the third post operative day. In a vast majority (over 70%) it reverted to sinus rhythm in less than 48 hours. In six patients (15%) it lasted more than 48 hours and in another six (15%) remained in atrial fibrillation and were discharged home in this condition.

Three (7.3%) patients didn't require any treat-

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TABLE 1

Probability of A.F. (Blinded)

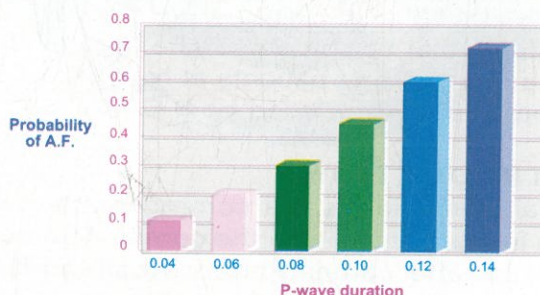
V1 P wave Duration (sec.)	Probability of A.F. (p value < 0.01)
0.04	0.12
0.06	0.20
0.08	0.30
0.10	0.45
0.12	0.60
0.14	0.73

ment and reverted back spontaneously. Fifteen (36.6%) patients were treated with digoxin and fourteen (34%) received amiodarone. Nine (22%) patients received a combination of digoxin and amiodarone and one (2.4%) patient was cardioverted. Pre operative p-wave duration in lead V1 was found to be the only statistically significant independent predictor for post operative atrial fibrillation on stepwise logistic regression analysis with a p value of <0.01. Males were found to be more likely to go into atrial fibrillation but this didn't reach statistical significance (p value < 0.068). As shown in table 1 and graph 1 the probability of developing atrial fibrillation increased with increasing p-wave duration. Thus for a p-wave duration of 0.04 seconds there was only a 12% probability of developing atrial fibrillation, while a p-wave duration of 0.14 seconds had a 73% probability of going into atrial fibrillation. The sensitivity, specificity, positive and negative values are shown in table-2.

DISCUSSION

Atrial fibrillation is the commonest arrhythmia in humans¹. It is also the commonest complication after coronary artery bypass grafting². It has now been clearly shown that atrial fibrillation is not a benign arrhythmia and it carries a high morbidity and mortality due to thromboembolism and cerebrovascular events⁴. This has led to new guidelines for anticoagulation. Anti-coagulation especially in

the elderly has a high morbidity and thus a combination of these two problems has led to a renewed interest in the treatment and prevention of atrial fibrillation. The etiology of atrial fibrillation after coronary artery bypass grafting remains unclear, but it has been reported that it results from multiple reentrant circuits, which necessitates areas of delayed conduction to initiate and maintain this rhythm⁵. The factors contributing to the development of atrial fibrillation after coronary artery bypass grafting are surgical trauma, inadequate atrial protection, cooling, post operative pericarditis, electrolyte abnormalities, myocardial ischemia and low output, hypoxemia or respiratory alkalosis, increased sympathetic activity, fluid retention and cardiotoxicity by pharmacological therapy². A number of studies have shown that post operative AF leads to increased early and late

Probability of A.F.

surgical mortality². It also increases the pre operative stroke and myocardial infarction rates thus leading to increased I.C.U. readmissions and longer hospital stays^{6,7}. All this drives up the cost of care⁴. With this realization a variety of interventions have been developed to treat and prevent the emergence of this arrhythmia with varying degrees of success. Prophylaxis with beta blockers and amiodarone has been shown to reduce the incidence of post operative A.F.^{7,8}. This study was designed to find predictors that could be used to predict the likelihood of developing atrial fibrillation. Strategies to identify the patients at risk and modifying their risk factors by aggressive prophylactic measures as well as changes in surgical technique should lead to a lower incidence of atrial fibrillation and reduce the morbidity and mortality of patients undergoing coronary artery bypass grafting.

Our study clearly shows that the probability of developing atrial fibrillation after coronary artery bypass grafting increases with increas-

TABLE 2

Diagnostic Tests

Specificity	93%
Sensitivity	12%
Positive predictive value	45%
Negative predictive value	71%

ing pre operative p-wave duration in lead V1, which represents prolonged atrial conduction. This was the only statistically significant independent predictive factor on stepwise logistic regression (p value < 0.01). From the table 1 and the graph 1 we can see that the p-wave duration of 0.04 second the probability of developing AF is 12% while for a p-wave duration of 0.14 seconds the probability is 73%. Thus patients with a pre operative p-wave duration of more than 0.1 sec have an almost five fold increased risk of developing atrial fibrillation. The diagnostic tests on our data revealed a specificity of 93%, a sensitivity of 12%, a positive predictive value of 45% and negative predictive value of 71%. The high specificity and negative predictive value shows that this model is more accurate at predicting the patients not likely to go into atrial fibrillation post operatively. Thus it can

be used to identify a group that is at high risk. The limitations of our study are at small size and the fact that it is a retrospective rather than a prospective analysis. The low sensitivity and positive predictive value of our data is a draw back too. Some studies have shown a higher sensitivity at predicting likelihood of atrial fibrillation using a signal averaged ECG^{9,10}. Other studies have also shown old age and large left atrial size as being independent risk factors for developing atrial fibrillation post operatively¹¹.

CONCLUSION

We conclude that pre operative p-wave duration can be used to identify people at high risk of developing atrial fibrillation after coronary artery bypass grafting. This cohort lends itself well to evaluation of further diagnostic and therapeutic modalities.

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