Research Article

Association Between SYNTAX Score and Carotid Artery Stenosis in Patients Undergoing Coronary Artery Bypass Graft (CABG)

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Abstract

Background: Stroke as a complication of open-heart surgery can be a cause of death and widespread disability.
Objectives: This study aimed to determine the relationship between the SYNTAX Score and carotid artery stenosis and evaluate patients undergoing open-heart surgery in terms of postoperative complications and mortality in a six-month to two-year follow-up period.
Methods: A cross-sectional study was conducted on 113 patients with CAD who underwent open-heart surgery at our hospital from 2016 to 2017. After collecting demographic data, the SYNTAX score, and color Doppler sonography report, the data were recorded and analyzed by SPSS22.
Results: In our study, most patients were male and aged between 50 and 70 years. The mean SYNTAX score was 32.667 + 13.668 in the group with significant carotid stenosis, 33.926 + 9.387 in the group with no significant carotid stenosis, and 30.868 + 9.963 in the group without carotid stenosis. The results showed no significant relationship between carotid artery stenosis and the SYNTAX score (P = 0.512) and no significant relationship between the SYNTAX score and surgical complications (P = 0.666).
Conclusions: According to the results, there is no significant relationship between the SYNTAX score and various indices related to heart disease, carotid artery stenosis, and postoperative morbidity and mortality. Thus, this index cannot be used to check and follow patients. However, further studies are needed to reach a definitive conclusion.

Keywords: SYNTAX Score, Carotid Artery Stenosis, Coronary Artery Bypass Graft

1. Background

Open-heart surgery is one of the most common methods of revascularization in patients with coronary artery disease (CAD), which is expected to be used increasingly. Despite the useful effects of this procedure, the complications of stroke can lead to mortality and widespread disability in some cases (1, 2).

Stroke is the second leading cause of death in the entire world (3). The etiology of stroke following surgery includes several factors such as carotid artery stenosis, hypotension, cardiac arrhythmia, aortic atherosclerosis, and severe and transient hypercoagulopathy (4). The existence of multiple coupled etiologies has caused a challenge in understanding the mechanism. Carotid artery stenosis is expressed as a major predictor of stroke after open-heart surgery. Evidence suggests that carotid stenosis is often an indirect cause of stroke after surgery (5). Given the importance of performing open-heart surgery, in order to mitigate the incidence of stroke after this surgery, concurrent procedures are doing in the heart and carotid artery (6). However, the findings continue to show an increase in the incidence of cardiac surgery side effects such as stroke or death (7). Given the importance of these complications, screening may be necessary to prevent them before surgery. The amount of the screening power also depends on the prevalence of the disease in the population under study, as well as the sensitivity and specificity of the screening tool (8).

The SYNTAX score has been introduced in recent years as a comprehensive angiography tool in the ranking of patients with CAD. This scoring system can improve the individual assessment of patients with CAD and facilitate clinical decision-making (6). Given the high predictive ability of this score in understanding CAD severity, it has also been suggested that this scoring factor may be used to predict carotid artery stenosis and stroke following open-heart

surgery. So far, few studies have checked this relationship and achieved contradictory results. On the other hand, no comprehensive study has been conducted to evaluate the relationship of the SYNTAX Score with carotid artery stenosis in terms of postoperative morbidity and mortality in patients undergoing open-heart surgery.

2. Objectives

Hence, based on the contradiction of the findings in previous studies and the necessity and importance of preventing the effects of this operation, this study aimed to determine the relationship between the SYNTAX score and carotid artery stenosis and evaluate patients undergoing open-heart surgery in terms of postoperative complications and mortality rate in a six-month to two-year follow-up period.

3. Methods

After obtaining approval from the Ethics Committee of Birjand University of Medical Sciences, Iran, a cross-sectional study was conducted on 113 patients who were candidates for open-heart surgery in Valiasr Hospital affiliated to Birjand University of Medical Sciences.

3.1. Inclusion Criteria

The study enrolled CAD patients without a history of carotid atherosclerosis that referred to ValiAsr Hospital, Birjand, from 2016 to 2017. All the patients underwent carotid color Doppler sonography, coronary diagnostic angiography, and open-heart surgery.

3.2. Excluded Criteria

Patients with a history of carotid atherosclerosis were not included in this survey. Also, patients who had not carotid color Doppler sonography and coronary diagnostic angiography for evaluation were excluded.

The demographic data of the patients and the SYNTAX score were collected from the medical records by a cardiologist. If the SYNTAX Score had not been calculated, the scoring was done based on the coronary angiography results and the SYNTAX algorithm (available on the SYNTAX website). The scope of the SYNTAX score is as follows: 0 to 22 = low, 23 to 32 = medium, and > 33 = high. Also, the report of carotid color Doppler ultrasound was checked to evaluate the degree of carotid artery stenosis, carotid intima-media thickness (CIMT), and carotid lesion (CL). In patients' follow-up, cardiovascular hospitalization,

neurological complications (TIA) and cerebrovascular accident (CVA), noncardiovascular hospitalization and mortality were checked for a period from six months to two years. Kolmogorov-Smirnov test was used to evaluate the normality of quantitative variables. It was found that the quantitative variable followed the normal distribution $P = 0.2$. Therefore, parametric tests, the independent t-test, repeated-measures analysis of variance (rANOVA), and analysis of variance (ANOVA) were used to check the hypotheses of the study. Data analysis was performed using SPSS21 statistical software at an error of 5%. The power of the study was 80% and the confidence interval was 95%.

4. Results

A total of 113 patients were evaluated, most of whom were male (69.9%) and aged 50 - 70 years. Other results on demographic information are presented in Table 1.

Table 1. Patient Demographic Information[a]

	Values
Gender	
Male	79 (69.9)
Female	34 (30.1)
Age	
≤ 50	10 (8.8)
51 - 59	36 (31.9)
60 - 68	36 (31.9)
69 - 77	22 (19.5)
≥ 78	9 (7.9)
Hypertension	67 (59.3)
Dyslipidemia	60 (53.1)
Smoking	20 (17.7)
Diabetes	47 (41.6)
Family history of coronary disease	30 (26.5)
Total	113 (100)

[a]Values are expressed as No. (%).

The results showed that 41.6% of the patients underwent on-pump surgery, and 58.4% underwent off-pump surgery. The frequency distribution of grafts and the type of drugs are indicated in Table 2. According to Table 2, most patients (75.2%) had three-vessel coronary artery obstructive involvement. None of the patients had artificial valves, and most of them (90.1%) had sinus rhythm. Besides, 99.1% of the patients had no peripheral vascular involvement, and only 12 (10.6%) patients had previous CVA. Also, only 14 (12.4%) patients had significant carotid stenosis, and seven

patients had cirrhotic lesions; and the mean values of CIMT and EF were 0.85 and 43.67 in these patients, respectively (Table 3).

Table 2. Clinical Characterization of Patients[a]

	Values
Type of operation	
On-pump	47 (41.6)
Off-pump	66 (58.4)
Number of grafts	
2	12 (10.6)
3	31 (27.4)
4	51 (45.1)
5	18 (15.9)
6	1 (0.9)
Artificial valve	0 (0)
History of CVA	12 (10.6)
Severity of coronary involvement	
LMCA	9 (8)
3VD	85 (75.2)
2VD	15 (13.3)
SVD	4 (3.5)
Heart rhythm	
Sinus	112 (99.1)
AF	0 (0)
Others	1 (0.9)
PVD	
Knee arteries	1 (0.9)
Femoral artery	0 (0)
Normal	112 (99.1)
EF $\leq$ 40	66 (58.4)

[a]Values are expressed as No. (%).

Although most of the patients (69.9%) had no postoperative complications, the complications of non-cardiac hospitalization, cardiac hospitalization, and neurologic events were 20.4%, 3.5%, and 1.8%, respectively. Besides, the mortality rate was observed merely in 4.4% of the patients.

The results presented in Table 4 showed that there was no statistically significant relationship between the type of surgery, the severity of vascular involvement, and the type of complication with the mean syntax score in patients (P < 0.05).

Table 3. Characteristics of Carotid Lesion and Coronary Stenosis[a]

	Values
Severity of coronary stenosis	
Significant	14 (12.4)
No significant	77 (68.1)
Without stenosis	22 (19.5)
Carotid lesion (CL)	
Circular	7 (6.2)
Non-circular	84 (74.3)
Without lesion	22 (19.5)

[a]Values are expressed as No. (%).

Table 4. Correlation of Complications and Severity of Coronary Stenosis with SYN-TAX Score[a]

SYNTAX Score	Values	Statistical Results
Severity of coronary stenosis		P = 0.512[b]; F = 0.675; Df = 2
Significant	32.667 ± 13.668	
No significant	33.926 ± 9.387	
Without stenosis	30.868 ± 9.963	
Complication		P = 0.666[b]; F = 0.597; Df = 4
Cardiovascular hospitalization	28.62 ± 4.23	
Neurological complications (TIA) and CVA	41	
Noncardiovascular hospitalization	34.27 ± 9.02	
Mortality	39 ± 10.44	
Without complication	33.5 ± 11.23	

[a]Values are expressed as mean ± SD.
[b]No significant.

5. Discussion

In this study, 47 (41.6%) patients had on-pump surgery, and 66 (58.4%) patients had off-pump surgery. This finding is consistent with the results by Campos et al. (7). However, the results of a study by Ravikiran et al. (8) were somewhat different from those observed in our assessment, and this may be due to differences in the study groups and different treatment approaches in the two studies.

This study showed that regarding the severity of coronary artery disease, most patients had three-vessel obstructive involvement, accounting for 75.2% of the patients. Also, 3.5% of the patients had one-vessel involvement, which was the lowest incidence of coronary artery involvement. This result is consistent with the results of

studies by Ravikiran et al. (8), Mombini (9), and Saedi et al. (10), and indicates a high prevalence of three-vessel involvement in coronary artery disease.

Most of the patients had no postoperative complications in our study, so that 79 (69.9%) patients had no complication, but other patients had complications, including non-cardiac hospitalization, cardiac hospitalization, and neurologic events with the rates of 20.4%, 3.5%, and 1.8%, respectively. Mortality was seen as one of the complications in only five (4.4%) patients, while Campos et al. (7) evaluated the mortality rate merely as one of the surgical complications in patients, which is different from our study findings.

In the present study, we found that carotid artery stenosis was not significantly correlated with the SYNTAX score (P = 0.512), which is in agreement with the results of studies by Ravikiran et al. (8), Saedi et al. (10), Costanzo et al. (11), and Ikeda et al. (12). However, Avci et al. (13) reported different results, although this difference may be due to differences in the methods and groups evaluated in the two studies.

In this study, the mean SYNTAX score was not significantly correlated with the type of surgery (P = 0.067), which is consistent with the study by Ravikiran et al. (8). However, the mean SYNTAX score was higher in the on-pump group than in the off-pump group, which could be due to the higher severity of coronary artery disease in the on-pump group.

There was no statistically significant relationship between the SYNTAX score and surgical complications in our study, which is consistent with the results of the study by Burlacu et al (14). This indicates that this procedure is less complicated. On the other hand, this finding is inconsistent with the results of the study by Campos et al., which may be due to differences in the study groups, as well as the therapeutic methods used in the two studies.

5.1. Conclusions

The results of this study showed no significant relationship between the SYNTAX score and various indices related to heart disease, carotid artery stenosis, and postoperative morbidity and mortality. Therefore, this index could not be used for patient follow-up. However, to reach a definitive conclusion, further studies are needed to prove this.

Footnotes

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