The Importance of Proximal RCA Stenosis is Associated with Severe OSAS Patients

Tolga Dogan, PhD1*, Baris Sensoy, PhD1iD and Aygul Gunes, PhD2iD

1Department of Cardiology, Bursa Yuksek Ihtisas Education and Research Hospital, Turkey
2Department of Neurology, Bursa Yuksek Ihtisas Education and Research Hospital, Turkey

*Corresponding author: Tolga Dogan, Department of Cardiology, Province of Bursa, Bursa Yuksek Ihtisas Education and Research Hospital, District of Yildirim, Neighbourhood of Mimar Sinan, Emniyet Street, 16310, Turkey, Tel: +90-5055772716, Fax: 0224-366-44-34

Abstract

Purpose: The aim of this study was to evaluate the relationship of regional selectivity in coronary arteries with OSAS severity using the Syntax (SX) score in OSAS (Obstructive sleep apnea syndrome) patients.

Methods: This retrospective study included 68 OSAS patients with coronary artery disease (CAD) who were followed up at Cardiology and Neurology Outpatient Clinic in our hospital between January 2019 and October 2020. Patients with previously diagnosed OSAS were separated into 2 groups as mild-moderate OSAS group (Group I) and severe OSAS group (Group II). In both groups, coronary angiography was examined using the SX score.

Results: There was no significant difference between the groups in respect of age, gender, smoking status, hyperlipidemia, hypertension and diabetes mellitus. The SX score of the severe OSAS group was significantly higher than that of the mild/moderate group (14 ± 8 vs. 8.3 ± 3 p < 0.01). RCA proximal critical lesion involvement was significantly higher in the severe group patients (p < 0.01).

Conclusion: The results of the current study showed that severe OSAS patients are at higher risk of advanced cardiovascular disease with a higher SX score. Evaluation of right ventricular functions and right coronary artery could be more important in severe OSAS patients.

Keywords

OSAS, Syntax score, Rright coronary artery

Introduction

Obstructive sleep apnea syndrome (OSAS) is a common disorder that manifests clinically as irregular snoring and sleep rhythm disorders. The apnea-hypopnea index (AHI) is the number of apnea and hypopnea events per hour of sleep documented during polysomnography. AHI is used as the main criterion to determine and classify the severity of the disease. OSAS is defined as AHI ≥ 5. It is often accompanied by diseases such as hypertension, arrhythmia, chronic pulmonary hypertension, type 2 diabetes mellitus, stroke and coronary artery disease (CAD) [1-3]. In many studies, OSAS is accepted as a traditional risk factor for CAD [4-8]. In patients with OSAS, oxygen saturation in the blood decreases as a result of shortness of breath caused by recurrent upper respiratory tract constriction or obstruction during sleep. This causes a series of pathophysiologic changes that result in inflammation, endothelial dysfunction, increased oxidative stress, and activation of the sympathetic system, and ultimately these may cause the onset of cardiovascular disease [9-11]. However, even in some studies, the relationship between cardiovascular outcomes and OSAS remains unclear [12,13].

The syntax (SX) score is an anatomic scoring system, which is used to score the severity of CAD according to the complexity, location and functional importance of the coronary lesion. A second use feature of this score is to determine between percutaneous coronary intervention (PCI) and coronary artery bypass grafting in preference for revascularization [14].

In a study with stable CAD using the SX score, it was shown that there is a linear relationship between moderate-to-advanced OSAS disease and the severity...
Guidelines and written informed consent was obtained from all participants (protocol number: 2011-KAEK-25 2020/09-06).

The SX score was used for angiographic evaluations of the participants. Exclusion criteria were defined as the presence of rheumatic heart disease, cardiomyopathy, pregnancy, or the use of continuous positive airway pressure (CPAP).

Methods

Patients

This retrospective study included 1535 OSAS patients in the Cardiology and Neurology Outpatient Clinic in our hospital between January 2019 and October 2020. The study flowchart was shown in Figure 1. Finally, 68 eligible patients were prospectively included in the analysis. The study protocol was approved by the Bursa Yuksek Ihtisas Education and Research Hospital Clinical Research Ethics Committee in accordance with the Declaration of Helsinki and Good Clinical Practice.

Patients and Methods

Patients

Patients received cardiology and neurology outpatient clinics between January 2019 and October 2020 (n = 1535).

Patients did not have an angiogram or poor quality

(n = 1412)

SX could not be calculated because patients had non-critical lesions

(n = 55)

68 patients were included in the study for evaluation

Figure 1: The study flowchart.
evaluated with the χ² test. A value of p < 0.05 was accepted as statistically significant in all analyses.

Results

The 68 participants comprised 36 (53%) in the severe OSAS group and 32 (47%) in the mild-moderate OSAS group. The mean age of the study population was 58 ± 8 years. The baseline characteristics of both groups are shown in Table 1. There was no significant difference between the groups in respect of age, gender, smoking status, hyperlipidemia, BMI (body mass index), hypertension and diabetes mellitus. The mean SX score of the severe OSAS group was significantly higher than that of the mild/moderate group (14 ± 8 vs. 8.3 ± 3, p < 0.01). In terms of coronary segmental regional selectivity, only the right coronary artery (RCA) proximal critical lesion involvement was significantly higher in Group II than in Group I. Other coronary artery proximal segment lesions did not differ significantly between the groups (p > 0.05) (Figure 2).

Discussion

The results of this study demonstrated that the SX score and rate of RCA proximal lesion were significantly higher in severe OSAS patients. The difference of this study from previous studies is to investigate whether there is any relationship between severe OSAS and segmental coronary artery disease. Therefore the importance of this study is that it gives clues about the relationship between severe OSAS and coronary artery segments.

The SX score is an angiographic grading procedure to evaluate the complexity of coronary artery disease and The SX score provides optimal revascularization strategies for patients with complex coronary artery disease, and high scores are associated with increasing cardiac mortality and major adverse cardiac events.

**Table 1:** Baseline demographic findings, proximal segmental involvement of coronary arteries and SX scores of both groups.

|                          | Group I (Mild/Moderate OSAS) | Group II (Severe OSAS) | P value |
|--------------------------|-------------------------------|------------------------|---------|
| Age (years)              | 57.1 ± 7                      | 60.2 ± 8               | 0.110   |
| Gender (F/M)             | 14/18                         | 14/22                  | 0.684   |
| Hypertension n (%)       | 18 (56)                       | 24 (67)                | 0.264   |
| History of Smoking n (%) | 23 (71)                       | 24 (67)                | 0.855   |
| BMI                      | 26.89 ± 3.39                  | 24.29 ± 4.41           | 0.35    |
| Hyperlipidemia n (%)     | 13 (41)                       | 17 (48)                | 0.29    |
| Diabetes Mellitus n (%)  | 10 (31)                       | 16 (44)                | 0.193   |
| Syntax Score             | 8.3 ± 3.4                     | 14 ± 8.3               | 0.001   |
| Proximal segmental involvement n (%) |           |                       |         |
| LAD                      | 8 (25)                        | 10 (28)                | 0.80    |
| Cx                       | 3 (9)                         | 10 (25)                | 0.17    |
| RCA                      | 4 (13)                        | 14 (39)                | 0.01    |

BMI: Body Mass Index

with AHI 5-30 and severe with ≥ 30 AHI events per hour. Sleep levels and AHI were manually assessed by certified sleep specialists according to the American Academy of Sleep Medicine criteria [16]. Patients with previously diagnosed OSAS were separated into 2 groups as the mild-moderate OSAS group (Group I) and the severe OSAS group (Group II).

In both groups, coronary angiography was examined using the SX score.

**Coronary atherosclerosis and syntax score:** Coronary angiographs of all patients were examined by an expert cardiologist using the SX score [In this study Siemens Artis Zee (Siemens AG, Wittelsbacherplatz 2, DE80333Muenchen, Germany) device was used]. Diameter ≥ 1.5 mm and diameter stenosis of intraluminal lesion ≥ 50% of all vessels were scored. A lesion causing > 50% narrowing in the lumen diameter was considered critical. The localization of vascular lesions was determined and recorded. The SX score was calculated using the SYNTAX Score calculator (http://syntaxscore.com/). SX score of ≤ 22 are classified as low risk, those between 23 and 32 as intermediate risk, and those with ≥ 33 as high risk [17].

**Statistical Analysis**

Data obtained in the study were analyzed statistically using SPSS vn. 21.0 software (IBM Inc., Statistical Package for Social Sciences, USA). Descriptive statistics were reported as mean ± standard deviation values for continuous variables with normal distribution, median and 25th-75th percentile values for continuous variables without normal distribution, and as frequency (n) and percentage for categorical variables. Group comparisons of continuous variables were made using the Student’s t-test and Mann Whitney U-test. Comparisons of categorical variables and evaluation of segment lesions (segmental regional selectivity) with OSAS levels were
and RV remodelling [28]. The reason for the severe stenosis in the RCA proximal segment, which was found high in our study, may be due to RV volume overload, especially. Early evaluation of proximal RCA may be considered in OSAS patients with evidence of right ventricular load and RV remodeling.

A limitation of this study was that the effect of OSAS on remodeling of the right ventricle was not evaluated with echocardiographic data, and IVUS could have been a more valuable method of evaluating endothelial functions. Further studies are needed to investigate the mechanism of these data.

Conclusion

The results of this study showed that severe OSAS patients are at higher risk of advanced cardiovascular disease with a higher SX score. Therefore, evaluation of right ventricular functions and the right coronary artery can be considered to be more important in severe OSAS patients.

Contributorship

All of the authors contributed planning, conduct, and reporting of the work. All contributors are responsible for the overall content as guarantors.

Funding

No funding.

Competing Interests

All of the authors have no conflict of interest.
Authors Declaration

The study was conducted with the approval of the Scientific Research Investigation Commission of Bursa Yuksel Ihtisas Educationand Research Hospital (Ethical approval number: 2011-KAEK-25 2020/09-01 date: 02.09.2020).

References

1. Buccheri A, Chinè F, Fratto G, Manzon L (2017) Rapid maxillary expansion in obstructive sleep apnea in young patients: Cardio-Respiratory monitoring. J Clin Pediatr Dent 41: 312-316.

2. Ben Halima A, Aouadi S, Bejjar D, Laroussi L, Boukhris M, et al. (2018) Hypertension and atrial fibrillation: What is the prevalence of obstructive sleep apnea syndrome? Tunis Med 96: 187-192.

3. Salmina D, Ogna A, Wuerzner G, Heinzer R, Ogna VF (2019) Hypertension arterielle et syndrome des apnées obstructives du sommeil: état des connaissances [Arterial hypertension and obstructive sleep apnea syndrome: State of knowledge]. Rev Med Suisse 15: 1620-1624.

4. Jiang YQ, Xue JS, Xu J, Zhou ZX, Ji YL (2017) Efficacy of continuous positive airway pressure treatment in treating obstructive sleep apnea hypopnoea syndrome associated with carotid arteriosclerosis. Exp Ther Med 14: 6176-6182.

5. Arous F, Boivin JM, Chacuat A, Rumeau C, Jankowski R, et al. (2017) Awareness of obstructive sleep apnea-hypopnea syndrome among the general population of the Lorraine region of France. Eur Ann Otorhinolaryngol Head Neck Dis 134: 303-308.

6. Luo H, Scholp A, Jiang JJ (2017) The finite element simulation of the upper airway of patients with moderate and severe obstructive sleep apnea hypopnoea syndrome. Biomed Res Int 2017: 7058519.

7. Karimzadeh F, Nami M, Boostani R, et al. (2017) Obstructive sleep apnea and obstructive sleep apnea-hypopnea syndrome. J Integ Neurosci 16: 127-142.

8. Alvarez-Sabin J, Romero O, Delgado P, Quintana M, Santamarina E, et al. (2018) Obstructive sleep apnea and silent cerebral infarction in hypertensive individuals. J Sleep Res 27: 232-239.

9. Alonso-Fernandez A, Garcia-Rio F, Arias MA, Hernandez A, de la Peña M, et al. (2009) Effects of CPAP on oxidative stress and nitrate efficiency in sleep apnoea: A randomised trial. Thorax 64: 581-586.

10. Cowie MR (2017) Sleep apnoea: State of the art. Trends Cardiovasc Med 27: 280-289.

11. Javaheri S, Barbe F, Campos-Rodriguez F, Dempsey JA, Khayat R, et al. (2017) Sleep Apnea: Types, mechanisms, and clinical cardiovascular consequences. J Am Coll Cardiol 69: 841-858.

12. Barbe F, Duran-Cantolla J, Sanchez-de-la-Torre M, Martinez-Alonso M, Carmona C, et al. (2012) Effect of continuous positive airway pressure on the incidence of hypertension and cardiovascular events in nonsleepy patients with obstructive sleep apnea: A randomized controlled trial. JAMA 307: 2161-2168.

13. Kohler M, Stradling JR (2010) Mechanisms of vascular damage in obstructive sleep apnea. Nat Rev Cardiol 7: 677-685.

14. Sianos G, Morel MA, Kappetein AP, Morice MC, Colombo A, et al. (2005) The SYNTAX Score: An angiographic tool grading the complexity of coronary artery disease. EuroIntervention 1: 219-227.

15. Kochergina NA, Kochergina AM, Ganyukov VI, Barbarash OL (2020) [Predictors of coronary plaque vulnerability in patients with stable coronary artery disease]. Kardiologiya 60: 20-26.

16. Patil SP, Ayappa IA, Capes SM, Kimoff RJ, Patel SR, et al. (2019) Treatment of adult obstructive sleep apnea with positive airway pressure: An American Academy of Sleep Medicine Clinical Practice Guideline. J Clin Sleep Med 15: 335-343.

17. Farooq V, Brugaletta S, Serruys PW (2011) The SYNTAX score and SYNTAX-based clinical risk scores. Semin Thorac Cardiovasc Surg 23: 99-105.

18. Zhang T, Zhang C, Chen RX, Shao B, Liu GA (2018) Correlation between coronary artery lesion quantitative score and OSAHS and relative risk factors. Eur Rev Med Pharmacol Sci 22: 1415-1420.

19. Zeng Y, Yang S, Wang X, Fan J, Nie S, et al. (2019) Prognostic impact of residual SYNTAX score in patients with obstructive sleep apnea and acute coronary syndrome: A prospective cohort study. Respir Res 20: 43.

20. Abinader EG, Peled N, Sharif D, Lavie P (1994) ST-segment depression during obstructive sleep apnea. Am J Cardiol 73: 727.

21. Javadi HR, Jalilolghadr S, Yazdi Z, Rezaie Majd Z (2014) Correlation between obstructive sleep apnea syndrome and cardiac disease severity. Cardiovasc Psychiatry Neurol 2014: 631380.

22. Sorajja D, Gami AS, Somers VK, Behrenbeck TR, Garcia-Touchard A, et al. (2008) Independent association between obstructive sleep apnea and subclinical coronary artery disease. Chest 133: 927-933.

23. Trenchca M, Deleanu O, Suţa M, Arghir OC (2013) Smoking, snoring and obstructive sleep apnea. Pneumologia 62: 52-55.

24. Davies PF (2009) Hemodynamic shear stress and the endothelium in cardiovascular pathophysiology. Nat Clin Pract Cardiovasc Med 6: 16-26.

25. Tan S, Liu X, Xu Y, Luo L, Zhou S, et al. (2017) Serum high-density lipoprotein correlates with serum apolipoprotein M and A5 in obstructive sleep hypopnea syndrome. Sleep Breath 21: 37-44.

26. Karkinski D, Georgievski O, Dzekova-Vidimliski P, Milenkovic T, Dokic D (2017) Obstructive sleep apnea and lipid abnormalities. Open Access Maced J Med Sci 5: 19-22.

27. Guan J, Yi H, Zou J, Meng L, Tang X, et al. (2016) Distinct lipid abnormalities. Open Access Maced J Med Sci 5: 19-22.

28. Chen Y, Li J, Lin X, Li H, Lu C, Li R, et al. (2020) Right ventricular diastolic dysfunction in patients with obstructive sleep apnea syndrome. Echocardiography 37: 317-322.