



Review Article

The Usefulness of Transesophageal Echocardiography to Assess Coronary Artery Blood Flow

Keisuke Sumii*, Tomohisa Tamai, Hiroe Hamaguchi and Koichiro Goto

Department of Anesthesiology, Saitama Sekishinkai Hospital, 2-37-20 Irumagawa, Sayama, Saitama 350-1305, Japan

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*Corresponding author: Keisuke Sumii, Department of Anesthesiology, Saitama Sekishinkai Hospital, 2-37-20 Irumagawa, Sayama, Saitama 350-1305, Japan, E-mail: mco.keisuke@gmail.com

ORCID: <https://orcid.org/0009-0004-1760-3155>

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Abstract

Evaluation of coronary artery blood flow using transesophageal echocardiography is a very useful noninvasive and rapid test, although there are some problems such as technical differences between examiners and angle dependency of blood flow evaluation. In coronary artery bypass surgery, it is useful to determine the degree of preoperative coronary artery stenosis and to evaluate grafts, and in Bentall surgery, it is useful to confirm that no medically induced coronary artery stenosis caused by coronary artery reconstruction has occurred. Further studies will be conducted to improve the accuracy and usefulness of this method.

Introduction

Intraoperative transesophageal echocardiographic assessment of coronary artery blood flow using the pulsed Doppler technique is noninvasive, rapid, and useful for evaluating intraoperative coronary artery stenosis [1].

The coronary arteries can be identified using transesophageal echocardiography: 1) the left coronary artery inlet and the entire length of the left main coronary artery can be seen between 1 and 2 o'clock on the clock in the short axis image (~45°) of the central esophageal aortic valve; 2) the left anterior descending branch can be obtained by slightly changing the probe depth and angle from the site in 1); 3) the right The detection sensitivity of 2D images combined with the pulsed Doppler technique is 97% for the left main coronary artery, 100% for the proximal left anterior descending branch, 94% for the left circumflex coronary artery, and 66% for the right coronary artery, as reported by Szilard Voros, et al. reported [2]. The sensitivity and specificity for detection of stenotic lesions were reported to be 100% and 100% for the left main coronary artery, 100% and 95% for the left anterior descending branch, 100% and 96% for the circumflex branch,

and 100% and 100% for the right coronary artery. On the other hand, T E Samdarshi, et al. reported 96% and 99% for the left main coronary artery, 48% and 99% for the left anterior descending branch, 67% and 100% for the circumflex branch, and 37% and 100% for the right coronary artery, respectively [3]. The degree of stenosis can be assessed by measuring the maximum diastolic blood flow velocity in the coronary arteries. S Nakatani, Zoltán Ruzsa, and colleagues reported that a left anterior descending branch velocity of 90 cm/s or greater indicates mild to moderate stenosis, and a left main coronary artery velocity of 112 cm/s or greater indicates stenosis with a coronary artery minimal lumen cross-sectional area of 6 mm² or less (FFR < 0.75 equivalent) [4-6]. Kazumasa Orihashi, et al. reported that the results of intra-graft blood flow patterns and velocities measured by transesophageal echocardiography correlated with the results of postoperative coronary angiography in the left internal thoracic artery, saphenous vein, and right epigastric artery, respectively, as evaluated after graft anastomosis [7,8]. In medically-induced coronary artery stenosis resulting from Bentall surgical coronary artery reconstruction, the maximum diastolic blood flow velocity by pulsed Doppler may be increased to 200-400 cm/s, sometimes requiring measurement by continuous wave Doppler. Pankaj



Garg, et al. reported successful Bentall surgery by using transesophageal echocardiography to evaluate a normal flow pattern of coronary artery blood flow [9]. In addition to the absolute evaluation of blood flow velocity, relative evaluation using transthoracic echocardiography may be useful in transesophageal echocardiography as well, with a 2-fold or greater acceleration before and after the stenosis indicating a stenosis of 50% or greater [10]. In the intraoperative TEE evaluation of CABG, the critical values for peak and mean velocities and velocity time integral ratios were 0.60, 0.73, and 1.06, respectively, whereas the sensitivity for each was 100% and the specificity was 92%, 94% and 89%, respectively [11].

However, there are caveats and limitations to the evaluation of coronary artery blood flow using the pulsed Doppler technique with transesophageal echocardiography. For example, the evaluation of coronary artery blood flow using the pulsed Doppler technique with intraoperative transesophageal echocardiography may be elevated in patients with increased cardiac output, moderate to severe aortic regurgitation, aortic stenosis or hypertrophic cardiomyopathy, which does not necessarily mean coronary stenosis alone [9]. It should also be noted that measurement errors may occur due to the examiner's technique, and accurate assessment may be difficult due to the angle-dependent nature of blood flow assessment using the pulsed Doppler method and the effects of respiratory variability during ventilatory management [12].

Conclusion

In coronary artery bypass surgery and Bentall's procedure, pulsed Doppler evaluation of blood flow in coronary arteries and grafts using transesophageal echocardiography is a useful tool to determine the presence of stenosis. Further studies will enhance its accuracy and usefulness.

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