Postoperative High Blood Glucose – A Potentially Treatable Marker Related to Atrial Fibrillation After Coronary Artery Bypass Grafting –

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Atrial fibrillation (AF) is one of the most common complications of coronary artery bypass grafting (CABG) and a major cause of concern because of its association with an increased risk of thromboembolic events.¹ In addition, AF can lead to hemodynamic compromise in response to the loss of effective atrial contraction during ventricular diastole and an irregular and abnormal ventricular filling time.

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Patients recovering from major surgery, such as CABG, are affected by a unique set of factors that may contribute to AF and are clearly very different from the stress factors of daily life (**Figure**). In a retrospective study of 199 consecutive CABG patients, Tatsuishi et al found a positive correlation between high postoperative blood sugar concentration (BS) and a higher incidence of post-CABG AF.²

Diabetes mellitus (DM) is one of the most common concomitant diseases in patients with AF.³ Many epidemiological studies have examined the risk of AF in relation to DM and

the chronic effects of hyperglycemia, but the results are conflicting. In a survey of hospitalized patients, AF occurred in 14.9% of those with DM compared with 10.3% in the control group made up of patients with hypertension but not DM.⁴ The Framingham Study identified DM as an independent risk factor for AF.⁵ Iguchi et al reported that among 41,436 residents of a Japanese city, the prevalence of DM was higher in those with than without AF (20% vs. 12%) and the multivariate analysis reported that DM was independently associated with AF.⁶ However, in the development of risk score for AF using the data from the Framingham cohort, DM was not a significant predictor.⁷ Thus, the mechanisms that cause AF seem to be complex and likely reflect the interactions of multiple factors such as in metabolic syndrome, depending on the underlying pathology and other patient-related factors.⁸ Moreover, some studies have questioned whether DM is a direct cause of AF while acknowledging the positive correlation between them. In the large cohort study of 34,720 females carried out by Schoen et al, there was a significant relationship between DM and the incidence of AF, but most of the increased risk attributed to

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DM seemed to be mediated through by the weight gain and higher prevalence of hypertension in this population.⁹ Perhaps the same trend would emerge in other previous studies subjected to additional data adjustment. Thus, whether DM alone contributes to the occurrence of AF may be difficult to determine.

Among the experimental studies, there is evidence that hyperglycemia itself increases the risk of AF, perhaps by prolonging P-wave dispersion, altering the corrected QT interval, impairing the modulation of potassium channels or of calcium ion handling.^{10,11} In their extensive review of the data on the contribution of the autonomic nervous system (ANS) to AF, Chen et al¹² postulated that activation of the ANS induces significant and heterogeneous changes in atrial electrophysiology, resulting in atrial tachyarrhythmias, including atrial tachycardia and AF. They also noted the importance of neuromodulation of autonomic functions, including as the basis for treatment, given that a reduction in autonomic innervation or outflow has been shown to reduce the incidence of spontaneous or induced atrial arrhythmias. Viskin et al showed circadian variation in the incidence of symptomatic AF in humans, an observation that indicated the importance of the ANS in atrial arrhythmogenesis.¹³

In the study by Tatsuishi et al² in this issue of the Journal, in addition to BS, another significant, and potentially independent risk factor of post-CABG AF was postoperative drainage volume. However, the focus of that study was the relationship between BS and AF, and drainage volume was not assessed further. A problem with their study that limited its value concerning high BS and the genesis of post-CABG AF is that fasting BS levels in patients with continuous insulin infusion and postprandial BS levels in patients receiving a sliding scale of insulin injection were considered together, even though fasting BS is a marker of glucose metabolism whereas postprandial BS is higher and its duration above the desired level differs between patients with DM and those without.

Despite its flaws, the finding by Tatsuishi et al of a significant relationship between postoperative BS and the incidence of AF has important implications that could improve the quality of post-CABG operative care: stricter control of BS may reduce the incidence of AF. Indeed, the benefits of tighter BS control have been demonstrated.¹⁴ Although the risk of hypoglycemia is a concern,¹⁵ adequate protection is easily achieved. Our conclusions are based on a consideration of the recent literature. A prospective interventional study that includes precise measurements of BS will be necessary to confirm the usefulness of controlling postoperative BS as a means to prevent AF (whether following CABG or after other major surgical procedures)

and to develop guidelines for AF prevention in patients at risk.

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