Is There Any Impact of ST Re-elevation on Patients With Acute Myocardial Infarction Following Reperfusion Therapy?

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Primarily percutaneous coronary intervention (PCI) to recanalize an occluded artery has been the main treatment for acute myocardial infarction (AMI), but a substantial number of patients still develop large infarcts. Impaired microvascular reperfusion, which is evaluated by the absence of resolution of ST-segment elevation (ST resolution) on the 12-lead ECG following reperfusion therapy, is considered to be associated with worse final TIMI (Thrombolysis in Myocardial Infarction) flow grade and large infarcts.¹ Furthermore, the measure of ST resolution has been reported to correlate with left ventricular function, survival, and reinfarction during long-term follow-up after both primary PCI and thrombolytic therapy.^{1–7} ST resolution occurs in 64–85% of patients, as shown in the **Table**.

Only a few previous reports have investigated the prevalence of ST segment re-elevation even though ECG is a standard and simple diagnostic modality. Matano et al reported that ST re-elevation occurred in 29% of the patients, but that there was no difference in ejection fraction (EF) at 1 month between the patients with and without ST re-elevation.⁴ In contrast, Okuda et al⁶ reported that ST

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re-elevation, despite initial ST resolution, occurred in 23% of the patients, and was associated with poorer EF at 6 months. They divided their patients into 3 groups (ST resolution without re-elevation, ST resolution with re-elevation, and no ST resolution), and showed the serial ECG changes (**Figure**). In this issue of the Journal, Cuenin et al⁸ report that 19% of 662 patients experienced ST segment re-elevation, but there were no differences in EF or death at 1 year between patients with and without re-elevation. Although the incidence of ST re-elevation was similar to that reported by Okuda et al, the effect on EF was inconsistent. Several differences between the 2 studies may have influenced the results. First, the timing of evaluation for ST re-elevation was different. Most previous studies evaluated ST resolution within several hours after reperfusion therapy, and ST resolution was consistently associated with better clinical outcomes. The mechanism of ST re-elevation is unclear and its occurrence suggests the possibility of re-infarction or pericarditis. In fact, stent

Table. Summary of Previous Studies

Authors	n	Year	Timing of ST resolution assessment	Incidence of ST resolution	Timing of ST re-elevation assessment	Incidence of ST re-elevation	Follow-up	Outcome
van't Hof et al ⁷	403	1997	1 h after	85%	NA	NA	3.1 years	Resolution: better survival
Matetzky et al ⁵	117	1999	1 h after	76%	NA	NA	2.5 years	Resolution: better survival
Claeys et al ¹	91	1999	At the end of PCI	64%	NA	NA	1 year	Resolution: better survival
Matano et al ⁴	51	2002	First day	NA	Once daily until 7 days	29%	1 month	Re-elevation: no difference (EF)
Brodie et al ²	1,005	2005	<4 h after PCI	85%	NA	NA	6.2 years	Resolution: better survival
Okuda et al ⁶	164	2008	1 h after PCI	73%	24 h after	23%	6 months	Resolution without re-elevation best EF
Cuenin et al ⁸	662	2018	1–1.5 h after	77%	5 days	19%	1 year	Resolution: better survival, re-elevation: no difference (EF)

EF, ejection fraction; NA, not applicable.

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thrombosis and pericarditis were present in 0.8 and 9.4% of cases, respectively, in the report by Cuenin et al.⁸ It is noteworthy that their results were similar after exclusion of all patients with stent thrombosis and pericarditis. As discussed by Cuenin et al, infarct expansion, reperfusion injury, inflammatory response, and edema may play a role in ST re-elevation. The timing of these phenomena following reperfusion therapy could differ, so the different time points used to assess ST re-elevation in the 2 studies may explain the conflicting results. Second, Cuenin et al included patients with an absence of initial ST resolution in their ST re-elevation group. However, considering that an absence of ST resolution is associated with worse EF, this point is

unlikely to explain the different outcomes. Third, primary PCI was performed in only 60% of the patients in the report by Okuda et al, compared with all patients in the report by Cuenin et al. The different reperfusion strategy might have affected the results.

Cuenin et al makes us realize that surprisingly few reports have investigated the significance of ST segment re-elevation following primary PCI, even though ECG is a simple and accepted tool. In addition, the newer generation drug-eluting stents demonstrate superior clinical outcomes as compared with bare-metal stents.^{9,10} Further studies in the current PCI era are warranted to determine the effect of ST re-elevation on patients with AMI following primary PCI.

Conflicts of Interest

The author received remuneration from Abbott Vascular, Kaneka, Daiichisankyo, and Terumo.

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