Is the Corrected TIMI Frame Count an Independent Predictor of Adverse Outcome?

To the Editor:

The corrected TIMI frame count (cTFC) has evolved into a standard measurement in many angiographic core laboratories. Although the reproducibility of the cTFC has been demonstrated,1,2 its superiority to TIMI flow grading has remained in question. Work done in our core laboratory has not found the cTFC to have predictive value independent of TIMI flow grading.3 The recent analysis by Gibson et al4 is the first to show that the cTFC correlates with adverse clinical outcomes. However, we are concerned that the analysis examined both cTFC and TIMI flow in separate multivariate models. This approach circumvents the real question of whether the cTFC adds any prognostic information over and above standard TIMI flow grading in a core laboratory setting. If not, the added time and substantial effort needed to measure cTFC cannot legitimately be justified.

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Response

We appreciate the comments of Bhatt and Ellis. In a previous study, they demonstrated the precision and reproducibility of the corrected TIMI frame count (CTFC) (r=0.97 between observers).1 Manginas et al2 also recently demonstrated the accuracy of the CTFC method; they showed a highly significant correlation with Doppler velocity wire flow reserve measurements (r=0.88). The CTFC had a more significant P value than TIMI flow grades in a multivariable model of outcomes in our recent article,3 and it also tended to segregate patients with TIMI grade 3 flow into lower and higher risk subgroups, ie, it provided independent prognostic information, as would be seen in a multivariable model.3 French et al4 also demonstrated a relationship between CTFC and outcomes.

Unfortunately, despite the fact that this index of flow was highly reproducible in the study by Bhatt et al,1 it did not achieve statistical significance in relation to a composite clinical end point. The very low rate of ascertainment (66%) in Bhatt et al’s study1 (ie, smaller sample size, type II error) may have negatively impacted their ability to demonstrate a relationship, and it is in sharp contrast to the rate found in a study by the TIMI group (97.2%).3 In Bhatt et al’s study,1 the incidence of adverse outcomes was 10% for TIMI grade 3 flow and 12.7% for TIMI grade 2 flow. This offers minimal risk stratification within patent vessels. In fact, the statistical difference across TIMI flow grades was most likely driven by differences between patent vessels (TIMI grade 2 and 3 flow) versus occluded vessels, which had higher risks of adverse outcomes of 20.5% (TIMI 0 flow) and 25.0% (TIMI 1 flow).1

Bhatt et al1 analyzed the CTFC in patients with and without events. It is likely that if the two ends of the CTFC flow spectrum were instead compared in the categorical fashion that mimics the statistical methodology used to compare the TIMI flow grades, then the CTFC would also be related to clinical outcomes. In the TIMI dataset, in-hospital mortality increased from 0.0% (n=0 of 41) in patients with a 90-minute CTFC <14, to 2.7% (n=18 of 658) in patients with a CTFC of 14 to 40, and to 6.4% (n=35 of 549) in patients with a CTFC >40 (P=0.003).3

Postintervention CTFCs were used in place of 90-minute CTFCs in the study by Bhatt et al.1 However, as in other studies that examine the time-dependent open-artery hypothesis, we reported the 90-minute CTFCs before the intervention.

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