Percutaneous Coronary Intervention for Chronic Total Occlusions

The Power of Negative Thinking*

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Impasses are common in everyday life. When they occur in coronary arteries as chronic total occlusions (CTOs), they may be difficult to treat. Successful treatment of CTOs sometimes requires a nonconformist approach based on “negative thinking,” which is described in philosophical circles as the mindset that “negates” the possibility of failure and replaces it with the potentiality of success (1).

SURVIVAL

The current study adds to the emerging data to suggest that successful CTO PCI improves survival. Revascularization may enhance survival if there are improvements in left ventricular function, a reduced risk of arrhythmia, or better tolerance of future acute coronary events (2–4).

In a systematic review of 13 studies of 7,288 patients, Joyal et al. (4) observed that successful CTO PCI was associated with a lower risk of death than failed CTO PCI (odds ratio [OR]: 0.56, 95% confidence interval [CI]: 0.43 to 0.72). In another analysis involving the UK Central Cardiac Audit Database for all CTO PCI cases performed in England and Wales between 2005 and 2009, George et al. (3) reported that successful CTO PCI of any target vessel was associated with an overall 28% reduction in mortality, as compared with failed CTO PCI. Of note, the survival advantage of successful CTO PCI did not depend on the location of the successfully recanalized vessel but was observed to be similar for the left anterior descending coronary artery (hazard ratio [HR]: 0.69, 95% CI: 0.49 to 0.97), the left circumflex (HR: 0.56, 95% CI: 0.38 to 0.82), and the right coronary artery (RCA) (HR: 0.73, 95% CI: 0.57 to 0.95). The finding of improved survival after successful CTO PCI of the left anterior descending coronary artery might be supported by the surgical literature (5), but the finding of improved survival after opening the left circumflex or RCA is puzzling.

The current report (2) puts the survival results into clearer perspective by first clarifying that successful CTO PCI resulted in lower in-hospital mortality rates than did failed CTO PCI (0.0% vs. 1.1%, p < 0.001). Additional observations suggest that the mortality differences after discharge were caused in...
part by confounding. Patients with successful CTO PCI were younger than those with failed CTO PCI and had lower rates of prior myocardial infarction (MI), diabetes, or prior stroke or coronary artery bypass graft (CABG) surgery. These observations suggest that patients with successful procedures were healthier at baseline than the patients who then “took a hit” from a failed CTO PCI. Not meant to be a criticism of a fine observational study, and as encouraging as the findings for successful CTO PCI are, the current analysis and the other observational studies have been unable to definitively determine whether long-term survival is attributable to the decision to intervene, the outcome of CTO PCI itself, or both.

No randomized study comparing CTO PCI with medical treatment alone has been reported. The EXPLORE (Evaluating Xience V and Left Ventricular medical treatment alone has been reported. The EXPLORE (Evaluating Xience V and Left Ventricular Function in Percutaneous Coronary Intervention on Occlusions after ST-elevation Myocardial Infarction) trial is a randomized, prospective, multicenter, 2-arm trial with blinded evaluation of endpoints that is actively enrolling 300 patients after primary PCI for ST-segment elevation MI with a CTO in a noninfarct artery. Patients are randomized to either CTO PCI or medical treatment within 7 days after MI. Endpoints include left ventricular function at 4 months and clinical outcomes at 5 years.

SYMPTOM RELIEF

Survival is not the only important outcome, and we must not hold CTO PCI to a higher standard than revascularization for other indications. Relief of angina is another important goal of CTO PCI. The current study was unable to test whether CTO PCI relieved symptoms in the 66% of patients with angina before treatment or in the remaining patients without angina. In 6 studies that reported anginal status, successful CTO PCI was associated with a significant reduction in angina (OR: 0.45, 95% CI: 0.30 to 0.67). Successful CTO PCI has also been associated with a lower need for urgent or elective CABG than failed CTO PCI.

NEGATING FAILURE

The current report identified several baseline characteristics associated with CTO PCI failure such as older age, prior MI, prior CABG, history of cardiac arrest, and target lesion in the RCA. Other studies suggested that lesion length, calcification, blunt stump, and a previously failed lesion were predictors of failure; and calcification, tortuosity, blunt stump, occlusion length >20 mm, and previously failed CTO PCI were predictors of crossing failure. Higher complexity also predicted longer procedures and increased consumption of resources. This is important, because the costs associated with CTO PCI may appear unattractive to administrators. An average CTO PCI case requires 9 guidewires, and many cases incur extra costs for adjunctive imaging, use of multiple stents, and additional vascular access sites.

TEACHABLE SKILLS

The authors of the current study have made a critical observation to make CTO PCI more efficient and successful. They observed that a larger annual volume of CTO PCI procedures per operator was associated with superior outcomes. Although only 8 operators performed 50 or more CTO PCI procedures per year, the busier operators had higher procedural success rates and lower complication rates than the less experienced operators.

Experienced operators recognize that side branches adjacent to CTO bifurcations are less likely to occlude after a retrograde than after an antegrade approach. They also recognize that subintimal passage probably occurs more commonly in CTO PCI than had been realized. Fortunately, it seems unlikely that a blunt device like a knuckled wire will exit the adventitial space.

The skills required for successful CTO PCI are teachable. Some authorities suggest that each center should identify 1 or 2 “super-specialists” to acquire expertise to perform CTO PCI. Regular meetings and proctoring are important components of successful CTO PCI programs. The acquisition of specialized skills is essential for wiring of collaterals, retrograde tracking, use of microcatheters and re-entry systems, limiting contrast use, and setting controls to reduce radiation exposure. Familiarity with advanced techniques leads to improved outcomes.

CONCLUSIONS

After successful CTO PCI, patients have less angina and may have gained a survival advantage. Because CTO PCI is challenging, achieving success often requires inventive approaches. In order to transcend the natural limitations of CTOs, interventional cardiologists might consider the philosophical tool of “negative thinking” to replace 1-dimensional techniques with multidimensional strategies.
augment the antegrade route with retrograde approaches, supplement a narrow selection of devices with a broad assortment of new wires and microcatheters, and so transform CTO PCI failures into clinical successes.

REFERENCES


KEY WORDS coronary artery disease, randomized controlled trials, stents, survival

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