Redefining "Worth It" for CTO PCI

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The utility of percutaneous coronary intervention for treating chronic total occlusion (CTO PCI) has been a subject of heated debate in the cardiovascular community for the last decade. CTO PCI is known—perhaps unfairly—for low success rates, questionable benefits, and a difficult, complex procedure, and many interventionalists prefer not to attempt it. Nevertheless, thanks to advances in technology and technique—and an expanding idea of what makes a procedure "worth it"—popular opinion appears to be shifting in CTO PCI's favor.

FINDING A MIDDLE GROUND

CTOs are blockages of coronary arteries that result from severe build-ups of fat or plaque and are a complication of coronary artery disease. Symptoms of CTO include shortness of breath, fatigue, or angina. Traditionally, physicians have treated patients with CTO surgically—CTO being one of the most common reasons for coronary artery bypass grafting (CABG) referral—or if surgery isn't feasible, with medical therapy. However, even CABG is often unsuccessful at revascularizing the CTO, says Alpesh Shah, MD, interventional cardiologist at Houston Methodist Hospital. Moreover, he says, many patients fall somewhere in between those two extremes, needing something less invasive and risky than surgery but more aggressive than medicine alone. For them, CTO PCI could be a game-changing option.

"On one end of the spectrum, we have patients who are very young and do not want to go through open heart surgery, but they are limited by their symptoms or quality of life. And on the other end, we have very sick patients who are not surgical candidates," Shah says. "Should we subject the young patients to CABG surgery, [which may or may not completely bypass the CTO segment]? Are non-surgical candidates going to be limited to medical therapy and continue to have quality of life or angina issues? [In these cases, CTO PCI may be an excellent alternative].

DEFINING BENEFITS

Alpesh Shah, MD

CTO PCI differs from standard PCI in a number of ways. In CTO PCI, the obvious challenge is getting across a completely blocked artery and creating a new channel.

"The more complex the technique, the higher the complication rates, especially at low volume centers," Shah says. "There are several specialized techniques, such as antegrade wiring and retrograde wiring, [that CTO operators must learn]. Compared to a routine PCI, a CTO PCI has higher complication rates."

Indeed, one of the difficulties with widespread adoption of CTO PCI is that not just any interventionalist can pick up the wires and get started. CTO PCI is a time-consuming, expensive procedure that requires operators to master a wide range of specialized tools and techniques, and the procedure's success is uniquely tied to his or her skill and experience. The success rate exceeds 85% in the hands of an experienced physician.[1] However, CTOs performed by inexperienced operator have much lower chances of success. For instance, Hannan et al.'s analysis of CTO PCI procedures in New York from 2009 to 2012 showed that operators who performed fewer than 9 CTO PCIs per year (half of all studied) had less than half the success of those who performed at least 48 annually (the top 25%).[2] Moreover, according to Massachusetts General Hospital, only 1 to 2 percent of cardiac interventionalists in the United States are able to perform the entire range of CTO PCI procedures.[3] Given this disparity in outcomes, the national average success rate (reported at around 59%)4 has little bearing on a given case's outlook—but it does shed some light on why,

historically, so few physicians have been keen to recommend CTO PCI.

ENHANCING TRAINING AND TECHNOLOGY

In recent years, studies such as Hannan's and registries like PROGRESS CTO are bringing the encouraging results of high-volume CTO PCI centers out of the shadows. Although high-volume, high-success centers such as Shah's program at Houston Methodist are few and far between, those centers are preparing a new generation of fellows to tackle complex CTO PCI procedures.

"Large academic centers usually have one designated CTO expert who often can teach fellows the required skills. In those programs, fellows are often exposed to almost 100 CTOs, which prepares them well for the real world," Shah says.

These fellows bring much needed experience and skills to the table just as recent advancements in technology are increasing the success rate of CTO PCI. Wire designs with higher crossing power, polymer-jacketed wires, and crossing catheters have all contributed to higher success rates. These advances, which reduce the likelihood of complications in CTO PCI, make the procedure a more attractive alternative to CABG.

IMPROVING PATIENT SELECTION

Another factor making CTO PCI more favorable is improvements in patient selection. With better patient screening and the development of risk assessments such as the PROGRESS CTO Score Calculator,[6] physicians can now identify who is best suited for CABG, PCI, or medical therapy, hopefully avoiding the unsuccessful outcomes or complications that have historically plagued CTO interventions.

"Overall, we have gotten better at patient selection," Shah says. "We work very closely with our cardiac surgeons to [evaluate] patients with complex anatomy, especially CTO vessels, to identify the right [procedure for each individual]. We weigh pros and cons of bypass surgery as well as a PCI. At the same time, we collaborate with our heart failure doctors who have many patients with very advanced coronary artery disease, often with multiple CTOs."

REDEFINING SUCCESS

Of course, determining whether or not a patient is physically qualified for CTO PCI is only part of the decision-making process; both patients and physicians must decide if the intervention is worthwhile. Without a clear survival benefit, "worthwhile" can be subjective. Although a patient may have severe symptoms that could be treated by CTO PCI, the procedure still has some risk for perforation and tamponade, donor vessel injury, myocardial infarction, and rarely, death.[5] Furthermore, some physicians believe that alleviating symptoms is not enough of a benefit to outweigh the risks. However, for the patient, improvements in quality of life may make the procedure worth it.

"I think an important question is, what are the options for our patient? Are they going to be limited to medical therapy but then continue to have quality of life or angina issues?" Shah says. "We've learned to ask our patients what their goals are. [If those goals are limited] by angina or shortness of breath, there's very significant benefit of CTO PCI."

In a field where survival is the ultimate goal, performing invasive (even minimally invasive) procedures for symptom improvement may challenge the traditional treatment paradigm. But for Shah, CTO PCI is an opportunity to change lives.

"For patients, It's like somebody has gone in and replaced their knee and now they can walk and run marathons if they wish to," Shah says. "I find this CTO PCI work most rewarding when it comes to patients' gratitude. They come and hug me and thank me because they certainly see a change in their life."

Conflict of Interest Disclosure:
Ryan Chang is an intern at the *Methodist DeBakey Cardiovascular Journal.*

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