Historical development. Chronic total occlusion is a problem not only for coronary but also for peripheral percutaneous angioplasty. It constitutes the major factor for the decision between percutaneous and surgical coronary revascularization. Figure 1 shows that in a consecutive cohort of patients with angiographically documented coronary artery disease, percutaneous transluminal coronary angioplasty (PTCA) was selected for less than half the patients if at least one occlusion was present, but for about three quarters of the patients if no occlusion was present.1

Above all, successful percutaneous recanalization reduces the subsequent need for coronary artery bypass surgery (Figure 2).2-4 A beneficial effect on left ventricular function can also be documented, but again is dependent on the long-term success of the procedure (Figure 3). As for a benefit in survival, a randomized study on recanalization of chronically occluded left anterior descending coronary arteries with 5 years of follow-up showed a trend toward improved survival (5 of 39 patients died in the conservative group compared with none out of 44 in the PTCA group; \( p = 0.006 \)) and a significant reduction in the development of chronic heart failure (10 patients versus 1 patient, respectively; \( p = 0.002 \)).5

The chance of success with percutaneous recanalization is difficult to predict. The major variables associated with success are depicted in Figure 4.7

The presence of bridging collaterals, a duration of occlusion of > 3 months, a missing stump, absolute absence of antegrade flow, or an occluded segment larger than 1.5 cm are instrumental for subsequent success.

The particular problem of restenosis and reocclusion with recanalized chronic total coronary occlusions has been intelligently analyzed on the basis of the data of the Multicenter American Research Trial with Cilazapril After Angioplasty to Prevent Transluminal Coronary Obstruction and Restenosis (MARCATOR) (Figure 5).6 Comparison of the follow-up angiograms of patients with occlusions to those of patients without occlusions showed that the restenosis rate was slightly higher and the reocclusion rate was markedly higher. The randomized Stenting in Chronic Coronary Occlusion (SICCO) trial showed a significant reduction of these two events when stents were used (Figure 6).9 The Total Occlusion Study of Canada (TOSCA) confirmed these measurements by and large but found no difference in event-free survival (Figure 7).10 Finally, a subanalysis of the Total Occlusion Trial of Angioplasty using Laser wire showed that the restenosis and reocclusion rates with and without stenting were not significantly different (Figure 8). This clearly indicates that stents have the potential to reduce restenosis, and particularly the difficult to redilate reocclusions, but that at least a quarter of occlusions fare equally well without stenting.

The influence of modern antiplatelet therapy with glycoprotein IIb/IIIa antagonists and thienopyridines has yet to be elucidated. The best techniques and treatments before, during and after the recanalization attempt will be specifically addressed in the following papers.

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Figure 1. Therapeutical decision in consecutive patients with angiographically documented coronary artery disease. The decision was heavily influenced by the presence or absence of at least one chronic total occlusion.7

Figure 2. Percentage of patients undergoing coronary artery bypass graft surgery up to 2 years, 3 years, 4 years, and 5 years after an attempt at percutaneous recanalization of a chronic total occlusion, stratified to the success of the procedure.

Figure 3. Left ventricular ejection fraction (%) at baseline and at 7-month follow-up in patients with initially successful recanalization of a chronic total coronary occlusion. The beneficial effect is dependent on long-term patency (Miyata, Japan, personal communication).

Figure 4. Influence of selected baseline variables on the success of a percutaneous recanalization attempt of chronic total coronary occlusions according to a literature review of about 5,000 patients.7 The bars indicate the expected success of the procedure according to whether or not the criteria had been met.

Figure 5. Comparison of restenoses and reocclusions of chronic occlusions versus non-total stenoses in the MARCATOR trial.8

Figure 6. Restenosis and reocclusion rates at 1 year in the SICCO trial randomizing patients to balloon or stent.9 Both are significantly reduced by the use of stents.

Figure 7. Angiographic and clinical follow-up results of 410 patients in the TOSCA trial randomizing patients to balloon or stent.10

Figure 8. Restenosis and reocclusion rates in the patients selected for balloon or stent treatment in the TOTAL trial (Hamburger, personal communication). There is no difference, which suggests that stents are not necessary in at least a quarter of patients.
REFERENCES