tins was restricted to 101 patients with JTT-705 and only 9 patients with torcetrapib. The effects on lipid profiles are promising, but these small numbers underline that our knowledge of pharmacologic CETP inhibition in humans is limited. Although the effects on surrogate end points for atherosclerosis are anticipated soon, many questions still need to be answered. For example, how will CETP inhibition affect lipid metabolism in patients with a high-triglyceride, low–HDL cholesterol phenotype? Together, the current data provide a basis for optimism, but only the long-term use of CETP inhibitors, either as monotherapy or combined with other lipid-lowering medications, will tell whether this novel drug will reduce the burden of cardiovascular disease. Fortunately, the clean safety profile is encouraging.

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Effect of Chronic Total Coronary Occlusion on Treatment Strategy

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In a registry analysis of 8,004 consecutive patients presenting for diagnostic catheterization at a single institution from 1990 to 2000, chronic total occlusion (CTO) was found in 52% of patients with significant (≥70% diameter stenosis) coronary artery disease. Peripheral vascular disease was the strongest clinical predictor of the presence of a CTO. In a multivariate analysis, CTO was the strongest predictor against the selection of percutaneous coronary intervention (PCI) as a treatment strategy, indicating that efforts to improve the success rate of PCI in CTO may have a significant impact on management of coronary disease.

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The frequency of chronic total occlusion (CTO) of coronary arteries in an unselected population is not well known, and previous studies from major referral centers are subject to selection bias. In addition, the influence of CTO on the management of coronary disease, particularly the selection of percutaneous coronary intervention (PCI) versus bypass surgery, is also unknown. The purpose of this study was to evaluate the frequency of CTO in an unselected population and to investigate the clinical predictors of CTO and the influence of CTO on treatment recommendations.

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This study was conducted with the approval of the institutional review board of the University of Washington. We reviewed diagnostic cardiac catheterization data from patients investigated for suspected or known coronary artery disease at the Veterans Administration Hospital in Seattle, Washington, from 1990 to 2000. The Puget Sound Health Care System has 291 acute hospital beds and approximately 80,000 enrolled patients. Nine staff cardiologists practiced in this center during the study period. According to institutional norms, data were prospectively collected at the time of cardiac catheterization, including age, gender, medical history, coronary angiographic results, the ejection fraction, and treatment recommendations. These data were retrospectively reviewed to assess for the frequency of CTO. Patients with previous bypass surgery or recent (<3 months) myocardial infarctions were excluded to identify patients with CTO. To analyze risk factors for CTO, we compared patients with significant coronary disease but no CTO with patients with CTO.

Significant coronary disease was defined as ≥1 lesion of ≥70% luminal diameter stenosis. Total cor-

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TABLE 1 Clinical Characteristics of Patients With and Without CTO

Variable	CTO: No (n = 1,475)	CTO: Yes (n = 1,612)	p Value
Age (yrs)	62 ± 10	62 ± 10	0.53
Hypertension (>140/90 mm Hg)	875 (59%)	1,023 (63%)	0.02*
Diabetes mellitus	405 (27%)	481 (30%)	0.14
Obesity (body mass index >25 kg/m^2)	221 (15%)	276 (17%)	0.11
Smoker	711 (48%)	840 (52%)	0.03*
Hypercholesterolemia (>200 mg/dl†)	657 (44%)	732 (45%)	0.63
Peripheral vascular disease	157 (11%)	279 (17%)	<0.0001*
Ejection fraction (%)	60 ± 14	53 ± 16	<0.0001*
Multivessel coronary disease	620 (42%)	1,064 (66%)	<0.0001*

Values are number (percent) or mean ± SD.
*Statistically significant at p <0.05.
†Total cholesterol.

TABLE 2 Location of Totally Occluded Coronary Arteries

Occluded Coronary Artery	No. (%)
Left anterior descending (proximal)	178 (8.4%)
Left anterior descending (distal)	183 (8.6%)
Diagonal	106 (5.0%)
Circumflex (proximal)	158 (7.4%)
Circumflex (distal)	178 (8.4%)
Obtuse marginal	273 (12.8%)
Right (proximal)	648 (30.4%)
Right (distal)	341 (16.0%)
Posterior descending/posterior left ventricular/acute marginal	65 (3.0%)

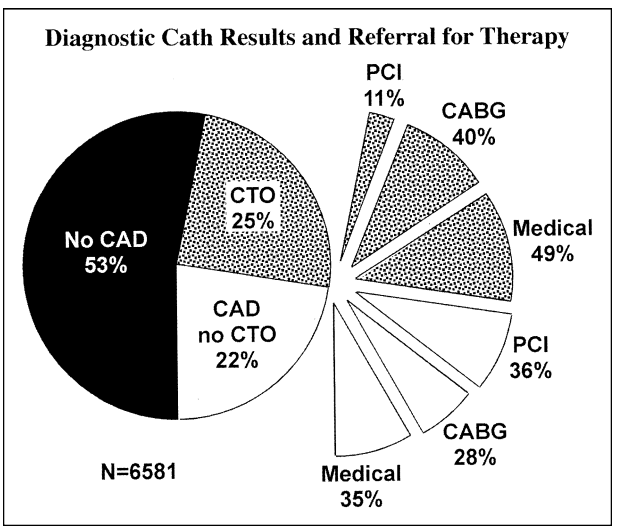

FIGURE 1. Diagnostic catheterization (cath) results stratified by treatment strategy. CABG = coronary artery bypass grafting; CAD = coronary artery disease.

onary artery occlusion was defined as 100% luminal diameter stenosis without a discernable lumen and the absence of anterograde flow. CTO was defined as total coronary artery occlusion of ≥3 months in duration. Multivessel disease was defined as ≥70% stenosis in ≥2 vessels.

Data are reported as mean ± SD. Continuous variables were compared using Student's *t* test, and categorical variables were compared using the chi-square test. Multiple logistic regression was used to perform a multivariate analysis of risk factors for CTO and influence on the choice of therapy. A p value of <0.05 was considered statistically significant. Data were analyzed with the Statistica software package, version 6.0 (StatSoft, Inc., Tulsa, Oklahoma).

We identified 8,004 consecutive patients from 1990 to 2000 who underwent diagnostic cardiac catheterization at a single institution. We excluded 1,423 patients with previous bypass surgery or recent myocardial infarctions. Of the remaining 6,581 patients, 3,087 patients (47%) had significant coronary artery disease. Of patients with significant coronary artery disease, a totally occluded coronary artery was present in 1,612 (52%). In all, 2,130 vessels were totally occluded, with 375 patients (12%) having >1 CTO.

Compared with patients without CTO, those with CTO had more frequent hypertension, smoking, and peripheral vascular disease (Table 1). The ejection fraction was significantly less in patients with CTO. Multivessel disease was present more frequently in patients with CTO. A multivariate analysis found that peripheral vascular disease was the strongest predictor of CTO (odds ratio [OR] 1.67, 95% confidence interval [CI] 1.35 to 2.08, p <0.001).

The territory supplied by the left anterior descending artery was involved in 444 patients (28%), the left circumflex artery in 560 patients (35%), and the right coronary artery in 1,027 patients (64%) (Table 2).

Compared with patients without CTO, those with CTO were recommended for PCI less frequently (11% vs 36%, p <0.0001) and bypass surgery (40% vs 28%, p <0.0001) or medical therapy (49% vs 35%, p <0.0001) more frequently (Figure 1).

A multivariate analysis of predictors of recommendation for bypass surgery or PCI was performed with a priori selection of the following variables for inclusion: age, the presence of diabetes, CTO, and multivessel disease (Figures 2 and 3). This analysis found that CTO was not an independent predictor of recommendation for bypass surgery (OR 1.1, 95% CI 0.94 to 1.31, p <0.21). The strongest predictor of recommendation for bypass surgery was multivessel disease (OR 6.2, 95% CI 5.1 to 7.4, p <0.0001), followed by increased age (OR 1.014 per year increase, 95% CI 1.006 to 1.022, p <0.001). A second a priori multivariate analysis of predictors of PCI with the same variables found that increased age, the presence of diabetes, CTO, and multivessel disease were all independent risk factors against PCI, with the strongest predictor being CTO (OR 0.26, 95% CI 0.22 to 0.31, p <0.0001).

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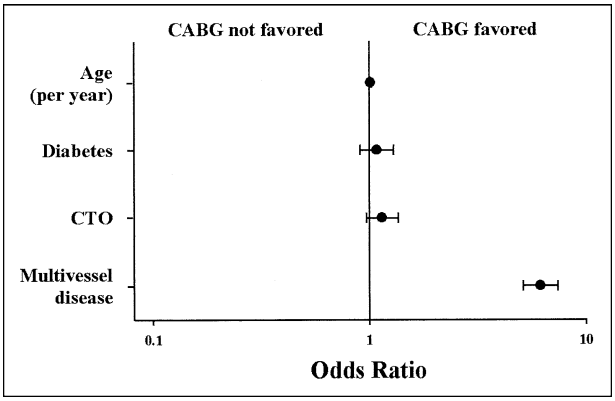

FIGURE 2. OR plot for the multivariable analysis of predictors of coronary artery bypass grafting (CABG).

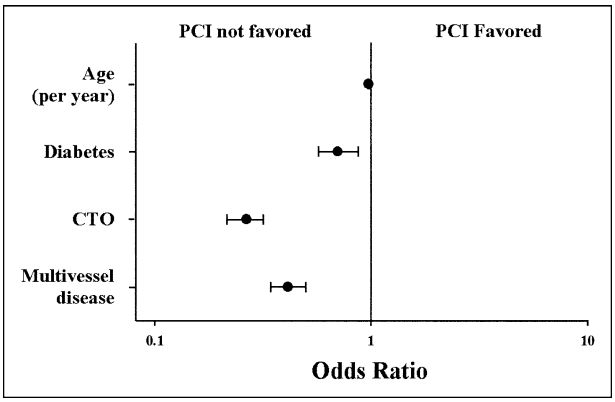

FIGURE 3. OR plot for the multivariable analysis of predictors of PCI.

This study is the largest series to describe the incidence of CTO in an unselected, community-based population. We found that a large percentage of patients in our population with significant coronary disease had 1 CTO (52%) or >1 CTO (12%). This contrasts with previous studies, which have documented a lower rate of CTO in such patients (9% to 40%).[1–4] Of these studies, the only community-based study, performed by Kahn,[1] found that in the study's cohort, 35% of patients with significant coronary disease (≥50% stenosis) had CTOs.[1] Our greater prevalence of CTO may be the result of a more stringent definition of significant coronary artery disease (≥70% diameter stenosis), leading to selection bias for more extensive coronary disease. It may also reflect a greater coronary disease quantity of plaque in this veteran population.

Our study is the first to report that hypertension, smoking, and peripheral vascular disease confer a greater risk for CTO in patients with significant coronary disease. Previous studies have either found no univariate risk factors,[5] younger age,[6] or previous myocardial infarction[2,6] to be univariate predictors of CTO. These differences may be a reflection of the greater prevalence of hypertension, smoking, and peripheral vascular disease in our group than the previously mentioned cohorts. Peripheral vascular disease may be the strongest risk factor for CTO, because claudication could limit exercise tolerance, preventing anginal symptoms from developing and allowing a stenosis to reach a high grade without clinical recognition.

The presence or absence of CTO appears to play a pivotal role in the recommendation for therapy.[2,7] In our cohort, patients with CTO were recommended for bypass surgery or medical therapy more frequently than PCI. It is intriguing to note that in a multivariable analysis, we found that CTO was the strongest predictor against PCI but did not predict a recommendation for bypass surgery. Instead, multivessel disease was the strongest predictor of bypass surgery. In deciding to recommend bypass surgery, it appears that other factors, such as multivessel disease and age, were more important than CTO in this cohort.

This study has significant limitations. Most patients were men, so our findings may not apply to women. During the study, significant advances were made in the medical and catheter-based treatment of coronary disease, which may have influenced the treatment choices and introduced bias. Finally, this study reflects the treatment recommendations given only at a single institution and may be a product of the local institutional bias.

The trend in cardiovascular medicine mirrors a similar trend in all areas of medicine, whereby patients and physicians are seeking less invasive alternatives to traditional surgical treatments. The aging of the population and the increasing prevalence of obesity, end-stage renal disease, and other surgical risk factors may also lead to an increased number of patients who are less suitable for cardiac surgery. New catheter-based developments in CTO management, such as intravascular ultrasound-guided wiring,[8] hydrophilic coated guidewires,[9] tapered-tip guidewires,[10] optical reflectometry,[11] and coronary artery stenting[12,13] have the potential to increase the initial success rate of PCI. The high rate of restenosis and reocclusion after PCI of CTO may be significantly reduced by drug-eluting stents.[14] These advances are likely to make the percutaneous treatment of CTO more feasible, durable, and safe in the future.

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Outcomes Following Elective Percutaneous Coronary Intervention Without On-Site Surgical Backup in a Community Hospital

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Despite guidelines to the contrary, limited numbers of elective percutaneous coronary intervention (PCI) procedures without on-site surgical backup are being performed, particularly in Europe and Canada. In the United States, many hospitals are considering establishing on-site surgical programs, in part to facilitate PCI. At a hospital with only off-site surgical backup, 562 elective PCI procedures were performed on 489 consecutive patients. Of these, 551 (98.0%) were successfully completed without major in-hospital complications; 5 patients (1.0%) had in-hospital complications, and 4 (0.8%) were urgently transferred. It is concluded that elective PCI with off-site surgical backup is feasible and safe for selected patients under specific conditions.
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Even before the use of stents became widespread, emergency percutaneous coronary intervention (PCI) during acute myocardial infarction without on-site surgical backup was found to be feasible and safe.[1–5] In Europe and Canada, this paradigm has been extended in many institutions to elective PCI. Although not endorsed by guidance committees,[6] similar programs now also exist in the United States.[7,8] The main criticism of these programs has not been that they are unsafe but that they are unnecessary: there are nearly 800 open-heart surgical programs throughout the United States.[9] About 500 additional centers have catheterization laboratories but no open-heart programs[10]; although many perform only diagnostic catheterizations, those that do perform PCI without on-site surgical facilities are considered by some not to have legitimate interventional programs. To add to the debate on whether it is wise to expend health care resources to establish on-site cardiac surgery programs, we sought to determine whether elective PCI with off-site surgical backup might be feasible and safe in selected patients, given a well-developed transfer plan.

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From February 1998 to October 2002, we performed 562 PCI procedures on 489 patients. All patients provided standard clinical informed consent, which included information that only off-site surgical backup was being provided; as an alternative, patients were offered PCI at Duke University Medical Center. To identify patients at lower risk for cardiovascular complications, patients selected for PCI met exclusion criteria agreed on by Alamance Regional Medical Center and Duke University Medical Center; specifically, no patient's age was >75 years, and no patient had class III or IV heart failure, left ventricular function <30%, acute myocardial infarction, cardiogenic shock, PCI immediately after thrombolytic therapy, refractory unstable angina, left main or 3-vessel disease, PCI of ≥2 major vessels, collaterals originating from the vessel targeted for intervention, complex lesion morphology (ostial location, bifurcation, heavy calcification, intracoronary thrombus, or total occlusion), or vein grafts. These characteristics have been shown to be associated with a moderate to high risk for in-hospital adverse events.[6,11,12] Data on patients excluded were not systematically collected during the

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