

Cardiologists' Use of Percutaneous Coronary Interventions for Stable Coronary Artery Disease

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Background: Percutaneous coronary intervention (PCI) is commonly performed in patients with stable coronary artery disease, despite current evidence suggesting that such patients derive minimal benefit from the procedure. We sought to determine the influences on cardiologists' decision to perform elective PCI in patients with stable coronary artery disease.

Methods: We conducted a qualitative study using 3 focus groups of interventional and noninterventional cardiologists in California. Participants discussed issues surrounding the decision to perform PCI using hypothetical case scenarios. We analyzed the data according to the principles of grounded theory.

Results: Despite acknowledging data showing that PCI offers no reduction in the risk of death or myocardial infarction in patients with stable coronary artery disease, cardiologists generally believed that PCI would benefit such patients. Reasons given for performing PCI included be-

lief in the benefits of treating ischemia and the open artery hypothesis, especially with drug-eluting stents; potential regret for not intervening if a cardiac event could be averted; alleviation of patient anxiety; and medicolegal considerations. Participants believed that, in patients undergoing coronary angiography, an "oculostenotic reflex" prevailed and all significant amenable stenoses would receive intervention, even in asymptomatic patients.

Conclusions: The widespread application of PCI in stable coronary artery disease for indications unsupported by evidence may reflect discordance between cardiologists' clinical knowledge and their beliefs about the benefits of PCI. Nonclinical factors appear to have substantial influence on physician decision making. Future studies should focus on the development of methods to help providers more fully incorporate clinical evidence into their medical decision making.

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PERCUTANEOUS CORONARY INTERVENTIONS (PCIs) are the most commonly performed coronary revascularization procedures, accounting for more than 60% of all revascularizations.¹ New technologies have increased the probability of short-term success with PCI, which may help account for the increase in its use. However, although rates of angiographic success are high, the net benefits to the patient depend on the situation in which PCI is performed.

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Evidence strongly suggests that an early invasive strategy improves outcomes in acute myocardial infarction (MI).²⁻⁵ However, in patients with stable coronary artery disease (CAD), meta-analyses have found that PCI offers no reduction in the risk of death or MI compared with medical therapy. In addition, PCI is associated with an increased risk of repeated revas-

cularization,⁶⁻⁸ and optimal medical therapy has been shown to provide a greater reduction in the time to the first ischemic event compared with PCI.⁹ The main benefit of performing PCI in patients with stable CAD appears to be relief of angina.^{10,11} In patients without angina, Spertus et al¹² found that PCI had no effect on quality of life for most patients, but that 13% of patients experienced reduced quality of life 1 year later. Furthermore, the emergence of data suggesting a small but meaningful risk of late stent thrombosis with the use of a drug-eluting stent (DES)^{13,14} has forced a closer examination of whether the benefits of PCI outweigh the risks, particularly in patients with stable CAD.

Multiple studies have found variation in PCI use by patients' sex and race¹⁵⁻²¹ and among geographic regions,^{22,23} suggesting that the decision to pursue PCI is not based on clinical data only. The medical decision making surrounding PCI is complex and requires physician judgment, which cannot be explored by quantita-

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Table 1. Hypothetical Case Scenarios Presented to Focus Group Participants

Scenario	
Case 1	
History	A 45-year-old asymptomatic man with a family history of MI has a calcium scan score of 745
Diagnostic test results	Exercise treadmill test; the patient completes 11 min on the Bruce protocol and has 1- to 2-mm ST depressions
Catheterization results	Tight lesion in his left anterior descending artery
Case 2	
History	A 55-year-old female smoker has a sharp pain in her chest; it is not associated with exercise and occurs mostly in the evening
Diagnostic test results	Exercise SPECT shows decreased tracer uptake in the anteroseptal region
Catheterization results	Tight lesions in her proximal right coronary artery and posterior descending artery
Case 3	
History	A 60-year-old man gets tired more easily in the evening; he has no chest pain or shortness of breath
Diagnostic test results	Exercise treadmill test with thallium imaging; the patient completes 6 min on the Bruce protocol and achieves 70% of maximum predicted heart rate; the ECG shows ½ mm ST depressions, and thallium images show mild reversibility in the inferolateral region with a normal ejection fraction
Catheterization results	A 70% focal lesion in the left circumflex artery

Abbreviations: ECG, electrocardiogram; MI, myocardial infarction; SPECT, single-photon emission computed tomography.

tive studies. In this study, we used qualitative methods to characterize cardiologists' current beliefs about PCI and its use in patients with stable CAD.

METHODS

STUDY SETTING

We conducted 3 focus groups throughout California in rural, suburban, and urban areas (Butte County, Orange County, and the San Francisco Bay Area, respectively) between April 18 and September 21, 2006. The institutional review board at the University of California–San Francisco approved the study.

RECRUITMENT

We used network sampling (contacting physicians on the basis of recommendations from other physicians) and purposeful sampling (selecting physicians on the basis of certain characteristics) strategies to ensure that local thought leaders would be included in the discussions and that a diversity of opinions would be represented. Local cardiologists in leadership positions in the American College of Cardiology and the Society for Cardiovascular Angiography and Interventions were asked to recommend interventional and noninterventional cardiologists from solo, group, and academic practice settings, although participants were not required to be members of either organization. A small honorarium was offered.

FOCUS GROUPS

The focus groups were semistructured, with the moderator using a focus group guide with 3 hypothetical case scenarios to facilitate the discussion (available from the authors on request).²⁴ All scenarios described patients with stable CAD who had no symptoms or who had atypical symptoms and represented cases in which the available evidence suggested no benefit of PCI (**Table 1**). The cases were pilot tested on cardiology fellows from the University of California–San Francisco to gauge reality and clarity and were modified on the basis of feedback received. Focus groups were 90 minutes long and were led by 1 or more of us. All participants gave written informed consent. The participants were presented with each case scenario in steps and were asked what they would do at each step, prompted by a list of op-

tions. In all scenarios, the patient had 1 or more significant coronary stenoses found at catheterization. Participants were encouraged to respond to other participants' comments, and the moderator invited participation from all group members.

FOCUS GROUP ANALYSIS

Discussions were audiotaped and transcribed. Analysis was performed according to grounded theory, a qualitative method in which data are categorized and explanatory theories emerge from the data.²⁵ Transcripts and notes were independently read and coded by 2 of us (G.A.L. and R.F.R.) using commercially available software (QSR N-VIVO, version 7.0; QSR International Pty Ltd, Doncaster, Australia). We used the constant comparative method for coding by applying codes identified in the first transcript to subsequent transcripts. Additional codes were added as new themes emerged. We used the following 2 methods of triangulation to reduce bias in the analysis: investigator triangulation (multiple investigators attended the focus groups and/or reviewed the transcripts) and disciplinary triangulation (the investigators represented different areas of expertise). A set of common themes seen throughout all focus groups was extracted from the coding and agreed on by all of us.

RESPONDENT VALIDATION

Participants were sent a summary of major themes from their own focus group and asked to rate their agreement with the summary points. Eighteen of 20 participants agreed or strongly agreed with the summary; 1 participant did not agree or disagree; and 1 participant disagreed.

RESULTS

Invitations were sent to 127 physicians; a heterogeneous group of 20 cardiologists participated (**Table 2**). Each group consisted of 4 to 9 participants and contained non-interventional and interventional cardiologists.

We identified themes related to physician factors, medicolegal concerns, and technological advances driving the decision to perform PCI (**Table 3**). No new major themes arose by the end of the third focus group. All themes reported were voiced in all groups.

Table 2. Characteristics of Focus Group Members^a

Characteristic	Total (N = 20)	Butte County (n = 7)	Orange County (n = 4)	San Francisco Bay Area (n = 9)
Male	17 (85)	6 (86)	4 (100)	7 (78)
Interventional cardiologist	7 (35)	3 (43)	1 (25)	3 (33)
Mean age (range), y ^b	55.5 (35-85)	54 (35-63)	60.5 (43-85)	53.5 (36-63)
Mean time in practice (range), y ^b	26.1 (1-54)	23.4 (1-30)	27.3 (3-54)	28 (27-31)
Type of practice				
Academic	3 (15)	0	3 (75)	0
Multispecialty group	14 (70)	5 (71)	1 (25)	8 (89)
Solo	3 (15)	2 (29)	0	1 (11)

^aData are expressed as number (percentage) of respondents unless otherwise indicated. Focus groups were in California.

^bNot all participants provided these data.

Table 3. Major Themes Regarding Cardiologists' Use of PCI

Physician Factors
Physicians have a firm belief in the benefits of PCI, despite acknowledgment of a lack of evidence of the benefit from the procedure for reduction in MI or death compared with medical therapy.
Personal experiences, such as young patients dying of coronary disease, and the fear of regret affect the decision to perform PCI.
Alleviating patient anxiety is one reason cardiologists order diagnostic tests and perform PCI for patients with stable coronary disease.
PCI is inevitable once a patient undergoes cardiac catheterization, particularly owing to an "oculostenotic reflex," in which cardiologists feel an irresistible urge to fix all significant lesions amenable to PCI.
Medicolegal Concerns
The fear of being sued if there is a bad outcome is a strong motivating factor for pursuing additional diagnostic testing and performing PCI.
The community standard is that positive and/or equivocal test results, regardless of the clinical situation, require further testing or intervention.
Technological Advances
The availability of new technologies, such as electron-beam computed tomography and computed tomographic angiography, has led to increased diagnostic testing in asymptomatic patients.
DESs have lowered the threshold for PCI, although more recent data have made some cardiologists more careful about using DESs in PCI.

Abbreviations: DESs, drug-eluting stents; MI, myocardial infarction; PCI, percutaneous coronary intervention.

PHYSICIAN FACTORS

Belief in the Benefits of PCI

Most participants believed that performing PCI would benefit the patients described in our case scenarios by preventing future cardiac events, even in asymptomatic patients. One noninterventional cardiologist noted, "Mortality from cardiac causes has steadily decreased over the last 30 years, so we must be doing something right. The evidence just hasn't caught up with us yet." Other participants acknowledged that medical therapy would be more likely than PCI to provide benefit in terms of preventing MI and death. However, the participants still believed in the benefits of performing PCI, as one person stated:

I think we all know that we're not necessarily preventing heart attacks by treating an asymptomatic stenosis. We're going to prevent the next heart attack because of lipid lowering, aspirin, and ACE [angiotensin-converting enzyme] inhibitors, but nonetheless that patient in our practice leaves the lab with an open artery, the best that my interventional partners can deliver.

Another major reason cited for performing PCI was the treatment of ischemia. As one participant put it, "We are driven by the new cardiology—to get rid of ischemia. The main job of cardiologists is to stamp out ische-

mia. We should have zero tolerance." This paradigm was dominant, even when participants were presented with stress tests with equivocal results or coronary stenoses in locations that did not match the ischemic regions on stress test results. In all groups, the benefit of an open artery was also mentioned as a reason to perform PCI in asymptomatic patients.

Personal Experiences and Anticipated Regret

Personal experiences contributed to participant anxiety about not performing revascularization in patients with CAD and played an important role in physician decision making. Several participants cited examples of asymptomatic patients who died suddenly of MI. One person told this story:

Jim Fixx was a famous guy whose father had died of an MI at an early age. I asked him, "Have you ever had an exercise test?" He said, "I don't need one, I run marathons," and I said, "Well, in view of your father's story, it wouldn't hurt," and he just laughed. Three weeks later, he dropped dead. There are a fair number of sudden deaths from CAD that never have angina.

Anticipatory regret owing to the possible consequences of not intervening on a lesion also emerged as a common theme. "You have data suggesting that the person has CAD. I don't think you can ignore that. If some-

thing happens, it's your fault," said one participant. Another stated, "[The lesion] is there, so it's hard to ignore. Despite agreeing with the literature on an intellectual level, this guy in our practice would get sent to the cath lab." Participants perceived a low risk of complications due to cardiac catheterizations and appeared to attach greater weight to the potential consequences of not performing PCI than to any potential complications caused by the procedure. These beliefs even extended to patients whom the participants thought should not have undergone any test or in whom a test result was believed to be falsely positive.

Patient Anxiety

Many participants cited alleviating patient anxiety as a significant factor in testing for CAD in asymptomatic patients. "If [the patient] is worried enough to come to you, I feel like you need to do some testing to reassure him," said one participant. This reason was particularly prominent for patients who self-referred to the cardiologist after having a test such as electron-beam computed tomography.

The Inevitability of PCI and the "Oculostenotic Reflex"

No matter why a patient was referred to catheterization, once a lesion considered significant was identified, the consensus about current practice was to proceed, in most situations, with PCI at the same time. One salaried cardiologist said, "I don't have any financial incentive to do procedures, but the reality is, by the time we're this far along, the die is cast. The cath lab staff probably wouldn't let us leave the lab unless we did something with the lesion." Another participant said, "Yes, medical therapy is as effective as PCI, but when I see a lesion, the bottom line is that the oculostenotic reflex always wins out." However, there was some recognition that yielding to the oculostenotic reflex, which refers to the practice of treating a coronary stenosis based on severity alone,²⁶ was potentially hazardous. "Some people have an eyeball that says anything needs angioplasty. There are times that your eyeball tells you it's a serious lesion, but many times it leaves you completely in the dark," remarked an interventional cardiologist.

Finally, the culture of the catheterization laboratory appeared to promote the use of PCI, even in asymptomatic patients, as described by some participants:

Speaker 1: "He's already gotten to the cath lab." [laughter]

Speaker 2: "There's no chance of escaping."

Speaker 3: "That's the end of it. He's not going to get out of the cath lab without a stent."

Speaker 1: "The only thing that would really change is if there had been an imaging study . . . and it would have changed it not by how you respond to the cath, but by not doing the cath at all."

MEDICOLEGAL CONCERNS

Medicolegal concerns were a strong motivating factor for pursuing additional testing and for intervening, even in

asymptomatic patients. Many participants believed that if an intervention was not performed and the patient subsequently had a cardiac event, it would be difficult to defend their decision not to intervene. "In California, if this person had an event within 2 years, the doctor who didn't [intervene] would be successfully sued," said one participant. "The standard of care is to do it. It would not be acceptable to do nothing."

The fear of lawsuits extended to the case scenario in which the stress test results did not match the coronary lesions. One participant said, "Now you're stuck [laughs]. I pursue this for legal reasons, and I feel that if something happens to this person, even if it's breast artifact or whatever, I'm stuck."

TECHNOLOGICAL ADVANCES

Participants thought that the availability of new screening technologies, such as electron-beam computed tomography and computed tomographic angiography, had increased the number of asymptomatic patients arriving at their offices with imaging study results suggestive of atherosclerosis. Once these patients presented, participants thought that they should be treated aggressively, including referral for catheterization and PCI, even while recognizing that the evidence showed that this approach would not prevent MI or death and might lower quality of life.

Participants believed that the advent of the DES had lowered the threshold for performing PCI, as these stents mitigated much of the risk of restenosis. As one interventional cardiologist said, "[The] DES does change your approach. You're a lot more confident that you can do something for the patient without it coming back and biting you."

Between the second and third groups, data emerged regarding the risk of late stent thrombosis with DES. Although the cardiologists in the third group stated that the new data made them more cautious, they still believed that most patients with coronary stenoses should have PCI.

COMMENT

We found that the current practice of cardiologists in our sample is to recommend PCI for almost all significant lesions seen at cardiac catheterization. The cardiologists believed they were benefiting even asymptomatic patients by performing PCI, particularly with the advent of DES. These beliefs persisted despite the participants' acknowledgment of evidence that PCI offers no benefit for mortality or prevention of MI for patients with stable CAD. This apparent gulf between evidence and practice appears to be motivated primarily by emotional and psychological factors.

Poses et al²⁷ found that physicians were pessimistic about the survival of medically treated patients with CAD and excessively optimistic about the benefits of revascularization. Cardiologists in our study were similarly positive about the benefits of PCI. This result may be the result, in part, of underuse of maximal medical therapy in patients with CAD,²⁸ so that patients may not have had an adequate trial of medical therapy before being referred for catheterization. Many participants also believed an open artery is ben-

eficial, despite evidence to the contrary.²⁹⁻³⁴ Regardless of the reason, cardiologists' confidence in the benefits of revascularization procedures exceeds the clinical evidence and likely contributes to the current high rate of revascularization procedures.

Previous studies^{22,23,35} have documented a high correlation between catheterization and revascularization rates, suggesting that the oculostenotic reflex (this phrase was widely used by participants) cited in the groups may be operative. When deciding whether to pursue an intervention, cardiologists discussed the technical feasibility of opening an artery more often than the clinical situation of the patient. This view was shared by most of the cardiologists in our groups, including the interventional and noninterventional cardiologists. In addition, although fee-for-service creates financial incentives to perform procedures, we found that even cardiologists in capitated settings held this view, indicating that factors other than payment are important to the decision to perform PCI. Finally, physicians' and patients' anxiety about abnormal test results, coupled with the ease of adding PCI during supposedly diagnostic catheterizations, has made PCI almost inevitable in any patient with a significant lesion.

Our data suggest that physicians are being influenced by psychological factors such as the availability heuristic, in which assessments of the probability of an event are influenced by the ease with which an event can be recalled.³⁶ Thus, a rare but dramatic event, such as sudden death in a younger patient, may produce strong memories and cause physicians to treat more aggressively, particularly if the perceived risk of harm from a procedure is small. In addition, participants in our groups expressed more potential for regret because of inaction (ie, not performing PCI) than because of performing procedures, which has also been called the "chagrin factor."³⁷ This chagrin, coupled with a fear of lawsuits (despite no data that increased use of diagnostic tests or procedures reduces the risk of being sued), appears to contribute to the tendency to intervene in situations in which there are no proven clinical benefits. Similar non-clinical factors affecting physician decision making have been described in other areas of medicine where physicians' actions are not consistent with the evidence base, such as with the prescribing of antibiotics for sore throats, overuse of screening tests for prostate cancer, and evaluation of chest pain in the emergency department.³⁸⁻⁴²

Our study indicates that technological advancement plays an important role in the expanded use of PCI. Cardiologists in the study perceived the benefits of DES to outweigh any risks, and these perceived benefits influence the decision to perform PCI. Although recent data have raised concern about the risk of late stent thrombosis with DES, the cardiologists interviewed after the new studies were presented still believed that the benefits of PCI generally outweighed the risks. This belief appears to be shared widely in the United States, where 80% of stents currently implanted are DESs.¹

There are some limitations to our study. Our results reflect the opinions of the individuals who participated and may also be affected by courtesy bias, where participants give responses they believe the interviewer wants to hear,

and interview bias, where interviewer reactions affect the responses given. However, we conducted multiple focus groups in rural, suburban, and urban areas with cardiologists from all types of practices, and consistent themes emerged, making it more likely that the opinions expressed reflect those of a high proportion of cardiologists. Our focus groups were conducted in California, which may limit the generalizability of our study results to other parts of the United States and to other countries, although the pattern of increasing PCI use has been seen worldwide.^{43,44} We used hypothetical clinical scenarios as a basis for discussion, which may not exactly mimic real-life clinical practice, and we presented only a few of many possible case scenarios. Assessing patient viewpoints could give further insight into physician decision making; however, patient interviews were beyond the scope of this study. Finally, while the focus group method is effective in identifying issues related to physician decision-making, it cannot directly measure the outcomes of those decisions.

The treatment of CAD is complex, and physician judgment is an important factor in the decision-making process. Although cardiologists may believe they are benefiting their stable patients with CAD by performing PCI, this belief appears to be based on emotional and psychological factors rather than on evidence of clinical benefits. Future studies should determine how physicians' decisions are influenced by nonclinical factors and should focus on the development of methods to help providers understand the basis of their motivations, to incorporate evidence from the clinical literature more fully into their medical decision making, and to find greater balance between their emotions and beliefs and the clinical evidence to provide the best treatment for patients.

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