Coronary Arteriography in Asymptomatic Patients after Myocardial Infarction*

The Need to Distinguish between Clinical Investigation and Clinical Care

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In this issue of Chest, Turner and coworkers (see page 58) describe the results of coronary arteriography in patients recovering from acute myocardial infarction (AMI). Patients recovering from AMI who are symptomatic should be appropriately evaluated, and this may include coronary arteriography and left ventriculography. The question being discussed in this companion article is whether all patients, that is, even the asymptomatic patient, recovering from an AMI should undergo coronary arteriography and left ventriculography. Turner et al studied the asymptomatic patient as part of the ongoing National Coronary Artery Bypass Surgery Study (CASS)\(^1,2\) and have correctly concluded that “Routine coronary arteriography cannot presently be advised in all asymptomatic patients after myocardial infarction despite the high incidence of multivessel coronary disease because of the uncertainty of bypass surgery in prolonging life.” They do not discuss in detail which asymptomatic patients should have coronary arteriography and why, nor do they present the results of left ventriculography. Patients undergoing coronary arteriography almost always also have left ventriculography, and thus, it is difficult to evaluate the need for routine coronary arteriography without also considering the results obtained from left ventriculography.

The usual steps taken before clinical application of a therapeutic regimen are:

1. Define the problem.
2. Identify subgroups of patients at high risk and also the cause for the high risk.
3. Prove efficacy of intended therapeutic regimen.
4. Apply the therapy to patient care.

Physicians often skip from Step 1 or 2 to Step 4 in their desire to help their patients and hope that in the years to come Step 3 will become available.

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This short-cut has worked in many instances, for example, treatment of acute pulmonary edema, heart failure, ventricular tachycardia and fibrillation, complete heart block, infective endocarditis, tetralogy of Fallot, transportation of the great arteries and severe valvular heart disease. The short-cut has worked because the patients were symptomatic and/or the clinical situation was often desperate and invariably life-threatening and at the same time alternative effective methods of therapy were not available. The primary goal was relief of symptoms and it was gratifying to see that often life was probably also prolonged. However, not all therapies have worked. Symptoms have not always been relieved and, in many instances, it has been difficult to be sure whether life was prolonged because the disease process has not been life-threatening immediately or in a very high percentage of patients in a short period of time.

The situation is radically different when one is dealing with the asymptomatic patient with coronary artery disease. This is because: 1) the goal of therapy obviously cannot be relief of symptoms. The expected goals of therapy in asymptomatic patients with coronary artery disease include prolongation of life, prevention of myocardial infarction, and preservation of an active, asymptomatic state for a longer period of time. 2) The risk of jumping from Step 1 (or 2) to Step 4 is that therapy may be applied to low-risk patients or a group of patients with varying risks. If the results of therapy are then compared to high-risk patients only or patients at higher risk, then an erroneous conclusion about the benefits of such therapy may be reached. Conversely, the lack of benefit of such therapy may also be erroneously concluded if the therapy is applied to high-risk patients and the results compared to patients at low risk. 3) The clinical course of patients with coronary artery disease is extremely variable. The mortality is high but not so high, either immediately or in a short
period of time, that application of a therapy to all patients will provide conclusive proof of pro-
longation of life. For example, recent data from Framingham show that the average death rate for
survivors of myocardial infarction is 5 percent per year for men and 7 percent per year for women
for the next ten years. Therefore, it is very likely that the expected goals of therapy in asymptomatic pa-
tients with coronary artery disease will be difficult, if not impossible, to prove without a well-designed,
properly conducted prospective study. This is a difficult but not an impossible task. Previously, this
has been successfully accomplished, as for example, the demonstration of the value of antibiotic prophyl-
axis in prevention of recurrence of rheumatic fever and the Veterans Administration Cooperative
Study demonstrating the value of control of hypertension. Physicians should feel proud of
this kind of track record of first proving the benefit of treating patients many of whom were asym-
ptomatic.

Coronary artery disease is a major cause of mor-
tality and morbidity in the USA (Step 1). After
myocardial infarction, asymptomatic patients with
normal blood pressure, ECG and chest x-ray film
are at extremely low risk. Patients at high or higher
risk of death after recovery from AMI (Step 2)
are known or can be reasonably surmised, as, for
example, those with left main coronary artery dis-
ease (LMCAD). These high-risk patients can be
identified by: 1) risk factors for coronary artery
disease—men, smoking, hypertension, diabetes and
hyperlipidemias; 2) heart failure; 3) cardio-
megaly; 4) ECG abnormalities; 5) ventricu-
lar arrhythmias on ambulatory ECG monitoring
during the convalescent phase of AMI; 6) left
ventricular ejection fraction, obtained from radio-
uclide ventriculography, of <0.40; 7) patients
with transient high-degree AV block during AMI; and
8) LMCAD. It should be noted that all
these known higher risk subgroups, except for
LMCAD, can be identified without exercise stress
tests m-mode echocardiography, contrast left ven-
triculography and coronary arteriography. Ejection
fraction can be reliably and reproducibly obtained
using radionuclide ventriculography; and in this
regard, sector-scan echocardiography needs to be
further evaluated.

A recent study of large numbers of patients
showed that the five-year survival of patients who
had recovered from nontransmural infarction was
similar to that of transmural infarction. These
data are different from an earlier study of smaller
numbers of patients followed-up for a shorter
period of time which showed that patients with
nontransmural infarction were at higher risk than
patients with transmural infarction. The Mayo
Clinic group drew attention to the instability of
patients with subendocardial infarction, and rec-
commended that these patients should be carefully
observed and that coronary bypass surgery was
indicated in the symptomatic patient.

The issue under discussion is coronary arteri-
ography, which is a diagnostic test. The need for
any diagnostic test must be evaluated by the in-
formation it provides, the risks of the test, whether
the same information could be provided by another
less risky and less costly test, and the therapy it
leads to. At the present time, coronary arteriography
is the only test that provides information about the
site, extent and severity of obstructive coronary
artery disease. The most common form of therapy
that such knowledge leads to is coronary artery
bypass surgery. The benefits of this procedure in
the asymptomatic or mildly symptomatic patient
are not known. In the mid-1970s, the National
Heart, Lung, and Blood Institute designed and
initiated the CASS study to answer this question and it
is currently in progress (Step 3). In occasional
asymptomatic patients, coronary artery bypass sur-
gery is needed, but why should coronary arteriogra-
phy be performed in the others? Although the
consensus of opinion of the Ad Hoc Committee of
the American Heart Association was that routine
coronary arteriography after acute myocardial in-
farction was not indicated, some differed in their
opinion. The reasons given as suggested by Turner
and colleagues in this issue, are to: 1) assess
prognosis. However, none of the publications de-
scribes how knowledge of coronary artery anatomy
helps in the individual patient. 2) Intelligently
advise a rehabilitation program. This is also not
explained. For example, if a patient is asymptomatic
and has three-vessel disease, should he/she be
stopped from working and his activity level reduced?
3) Define optimal medical management.

The value of coronary arteriography is not clarified
on this issue. For example, how does knowledge
of site and extent of coronary arterial obstruction
influence decisions about treating the smoking
habit, hypertension, arrhythmias, heart failure, etc?
4) Define optimal surgical therapy. How does
knowledge about coronary arterial obstruction help
in decisions about surgery in asymptomatic pa-
tients? LMCAD is one, and may be the only an-
swer. LMCAD occurred in 7 percent of asym-
ptomatic patients in the study of Turner et al (this
issue). It is also possible that patients with
LMCAD may have been included in the high-risk
subgroups previously cited, such as those with left
ventricular ejection fraction <0.40 and ventricular
arrhythmias.
If one were performing coronary arteriography for LMCAD (and more than 90 percent of asymptomatic patients will not have LMCAD), then:
1) Is the yield high enough to recommend coronary arteriography for all asymptomatic patients after AMI? It needs to be emphasized that the benefit of coronary artery bypass surgery in prolonging the life of patients with LMCAD has been proven only in symptomatic patients and that the survival of medically treated symptomatic patients with LMCAD is unfavorable but not totally hopeless. The overall survival of medically treated but operable patients at six years is 44 percent.28,29 At ten years, the survival of inoperable patients is 0 percent, of medically treated but partially revascularizable patients 13 percent, and of patients suitable for complete revascularization it is 31 percent.18 In other words, the patients who would have the best results with surgery also have the best results with medical therapy. Also, it is possible that asymptomatic patients with LMCAD may have symptoms prior to "unexpected" death and thus could receive coronary artery bypass surgery when they become symptomatic. Therefore, the potential delay in diagnosis of some asymptomatic patients with LMCAD is not of necessity a reason for performing coronary arteriography in all symptomatic patients after AMI.
2) How many of those without LMCAD will be operated on anyway for other (questionable) reasons, such as anatomy or physiology? It needs to be re-emphasized that data about LMCAD cannot be applied without proof to combined disease of proximal left anterior descending and proximal left circumflex coronary arteries, the so-called left main equivalent disease,30 or to three-vessel disease. In the report of Karimian et al.,26 8 of 34 asymptomatic patients were operated on; the yield is low. The reasons for operation in these 8 patients are not stated; therefore, it is possible that the true yield may be lower.

These largely unproven benefits have to be balanced against the risks of left heart catheterization. In many centers, the risks are small. In 1969, Begg and coworkers31 reported the feasibility of coronary arteriography and left ventriculography after AMI. At about the same time, other centers reported successful left ventricular catheterization soon after AMI at low risk.32,41 We have studied, 1) from 1969-1971, more than 100 patients (some of whom had left ventriculography and coronary arteriography) in the acute and convalescent phases of myocardial infarction with no deaths and no myocardial infarction;33-41 2) 100 acutely ill patients with no deaths and no MI;42 and 3) 171 patients with LMCAD with one death three days later and no MI.28,29 Subsequently, others have also studied patients convalescing from acute MI with low incidence of complications.22,43,44 Recent data from many centers are important; in the CASS involving 13 centers,1 the overall mortality rate was 0.20 percent, and the myocardial infarction rate was 0.25 percent. Ventricular fibrillation occurred in 0.63 percent, arterial emboli in 0.09 percent, arterial thrombosis in 0.49 percent and arterial dissection in 0.25 percent. LMCAD increased the risk of death by 6.8 times in the CASS study. Others have also reported a low45-52 while some have reported a much higher53-54 risk of complication with coronary arteriography, particularly in the presence of LMCAD.52,54,56-58 Clearly, the risks are low, but are not zero. If the yield of patients needing surgery is low and the indications for coronary arteriography in the asymptomatic patient are poorly defined and of unproven value, are even the low risks justified? If not, then one might submit that the major risk of coronary arteriography in asymptomatic patients may not be the risk of coronary arteriography itself, but that of unproven, and therefore, unnecessary coronary artery surgery.

For all these reasons, one would have to conclude that coronary arteriography is not clinically indicated at the present time for all asymptomatic patients after AMI, that is, we have not been proven ready for Step 4.

Conclusions

It is reasonable that: 1) In symptomatic and asymptomatic patients recovering from AMI, we should pay meticulous attention to the less exciting and more time-consuming therapeutic maneuvers. These include encouraging the patient to stop smoking, controlling hypertension, correcting hyperlipidemia, controlling diabetes mellitus, correcting overweight and preventing deconditioning. Angina, heart failure, complex ventricular arrhythmias and other complications should be appropriately treated. Discontinuing smoking,39 beta blockade,59-61 and sulfinpyrazone62 have been shown to be of value. The role of beta blockade and of coronary artery bypass surgery are currently being further evaluated by cooperative studies sponsored by the National Heart, Lung, and Blood Institute.

2) In the symptomatic patient, diagnostic tests and therapy should be goal-directed.

3) In the asymptomatic patient, diagnostic tests and treatment should continue to be clinically investigated by well-designed, proper protocols in which the patient is a fully informed partner.

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