

RISK STRATIFICATION IN PATIENTS WITH CARDIAC DISEASE UNDERGOING NON CARDIAC SURGERY

*Mohammad Ishaq**

The most common cause of morbidity and mortality in major surgical procedures are complication related to cardiovascular disease¹. Preoperative evaluation of patients with known or suspected heart disease is a major clinical challenge. Over the past 2 decades significant advancement has evolved in the assessment of cardiac risk prior to surgery. Early workers focused on the identification of surgical procedures that carried high risk. Later significant development was shifting the focus on identifying those patients who carried increased risk of cardiac complications during surgery. This has been made possible due to the advent of safe and sensitive cardiac testing and imaging modalities in particular dobutamine Echocardiography (Stress Echo) and Dobutamine/lipyrademole and thallium testing. Coronary Angiography relatively old and an invasive modality is indicated but has not shown to be cost effective given the low overall incidence of severe coronary artery disease (CAD).

Combination of clinical evaluation and non-invasive cardiac testing is the most efficient and appropriate method of identifying the patients at high risk of perioperative cardiac complications.

CLINICAL EVALUATION

Lee Goldman then a resident at Massachusetts General Hospital, USA conducted a study that identified clinical factors responsible for elevated risk of surgical complications in a study of 1000 consecutive patients undergoing elective surgery at the Mass Gen Hospital². Goldman and his colleagues identified following clinical markers of increased cardiac risk:

1. History of recent Myocardial Infarction (MI) < 6 months
2. Congestive Heart Failure (CHF)
3. Critical aortic stenosis
4. Significant non-cardiac organ failure/disease
5. Urgency of Surgery
6. Advanced Age

L'Italien & others reviewed the clinical risk factors of patients undergoing elective vascular surgery at the Mass Gen Hospital, University of Massachusetts Medical center and Vermont Medical Centre. By using the thallium functional testing they analysed the clinical risk prior to surgery³. This group identified fewer clinical markers of high risk like old age, history of Diabetes Mellitus, MI, Angina or CHF.

* Dr. Mohammad Ishaq FRCP
Associate Professor of Cardiology
National Institute of Cardiovascular Diseases,
Karachi, Pakistan.

Correspondence:

Dr. Mohammad Ishaq FRCP
e-mail: khyber50@yahoo.com

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These findings were supported by other groups who demonstrated that the absence of any of these markers conferred very low risk (3%) while the presence of one or two risk factor conferred moderate risk (8%) while the presence of 3 or more risk factors conferred higher risk of death or MI during vascular surgery (18%). (Table-I)

Paul et al. reviewed the cardiac catheterization results of 878 consecutive patients undergoing elective vascular surgery at the Cleveland Clinic⁴. They based their assessment on the above five markers of increased risk & observed that the presence of three or more risk factors was coincident with a high likelihood of left main or three vessel coronary artery disease. Similarly the absence of these markers was

coincident with low likelihood of severe CAD.

NON-INVASIVE TESTING

The evaluation of sensitive non-invasive tests for CAD in particular pharmacologic stress test has greatly influenced the pre operative cardiac risk assessment. Several studies have demonstrated very high sensitivity of these tests for identifying high-risk patients for perioperative cardiac complications. Boucher et al demonstrated that thallium scanning before elective vascular surgery clearly identified those patients who suffered cardiac complications at surgery⁵. It was also noted that those patients with a normal thallium study had a very low incidence of cardiac complications.

Table - I: Clinical Markers of Cardiovascular Risk in Non Cardiac Surgery

I. Major

- * Recent Myocardial Infarction (MI)
- * ACS/Advance ANGINA CCS III/ IV
- * Overt Cardiac Failure (CF < 40 %)
- * II/III degree AV Block
- * Severe valvular Heart Disease
- * Significant arrhythmias due to underlying Heart disease

II. Intermediate

- * Previous MI
- * Stable Angina
- * Controlled CHF
- * Diabetes Mellitus

III. Minor

- * Old Age
- * Abnormal ECG in the absence of cardiac symptoms
- * Absence of sinus Rhythm
- * Uncontrolled Hypertension (HBP)
- * Previous stroke
- * Poor functional capacity

Though Thallium testing has a very high sensitivity (85-100%) it's specificity is fairly low. For this reason the negative predictive power of thallium is as high as 95%, combining all current clinical evidence. The positive predictive power is however quite low because of the low specificity. This makes Thallium testing a reassuring modality when negative but clinically confusing when positive.

DOBUTAMINE ECHO test has been examined in few studies as a perioperative screening modality. Interestingly the benefits of Echo stress test are quite similar to those found with Thallium testing. It too has a high sensitivity but the problem of low specificity remains. In best hands the results of Echo stress testing are comparable to thallium testing. However Dobutamine Echocardiography has the advantage of providing information regarding valvular structure and function as well which is of great importance in our patient population where Rheumatic Heart Disease (RHD) is still a common condition.

Conventional exercise tolerance testing (ETT) with out myocardial imaging also has an important role in screening for cardiac risk. Properly conducted ETT combined with appropriate Echocardiographic interpretation (assuming a normal baseline ECG) has great prognostic power in patients with known or suspected CAD.

Modified from AHA guidelines: Circulation 1996, 93:1278-1317.

ACS: Acute Coronary Syndromes
CCS: Canadian Cardiac Society

Achievement of maximum predicted heart rate without ECG evidence of ischaemia confers a low risk for cardiac complications. ETT is widely available and is the most economical of all the cardiac tests.

INVASIVE TESTING

Cardiac catheterization & Coronary Angiography has been proposed as a screening modality for patients undergoing high-risk surgery for example peripheral vascular reconstruction. A study from Cleveland Clinic on the use of Coronary Angiography on 1000 consecutive patients undergoing vascular surgery reported a high incidence of patients with severe coronary disease requiring CABG⁶.

However subsequent review of the data suggests that most of those patients with severe CAD requiring coronary revascularization could be identified on clinical evaluation. Current state of knowledge therefore suggests clinical and functional assessment as the most appropriate and cost effective initial screening modality for cardiac risk & does not support the use of coronary angiography in general terms for perioperative risk evaluation.

LOWERING THE PERI OPERATIVE CARDIAC RISK

In order to carry out a definitely indicated major surgical procedure in the presence of definite CAD various therapeutic methods have been studied to reduce the risk of cardiac complications:

1. CABG

Mechanical coronary revascularization by surgery is one such interventional modality. A retrospective review of Coronary Artery Surgery Study (CASS) registry supports such a protective effect⁷. These data show that patients undergoing elective vascular surgery who had previously undergone CABG did better than those who had a comparable CAD but did not undergo CABG. Data from Cleveland

Clinic has shown similar findings supporting the idea that a successful CABG confers a lower risk of cardiac complication in major elective surgery.

2. Per cutaneous Coronary Intervention (PCI)

There is conflicting data on the results of PCI versus medical therapy and CABG on the risk of perioperative cardiac complications.

Previous randomized studies comparing medical treatment with angioplasty in patients with stable CAD have demonstrated an increased risk rate in those undergoing Angioplasty. Posner et al reported a lower rate of cardiac complications in patients who underwent Angioplasty as a preoperative procedure compared to those who were treated medically⁸. Massie et al in a case control study comparing patients with abnormal Thallium studies who did or did not undergo coronary Angioplasty prior to surgery found no difference in cardiac event rate⁹.

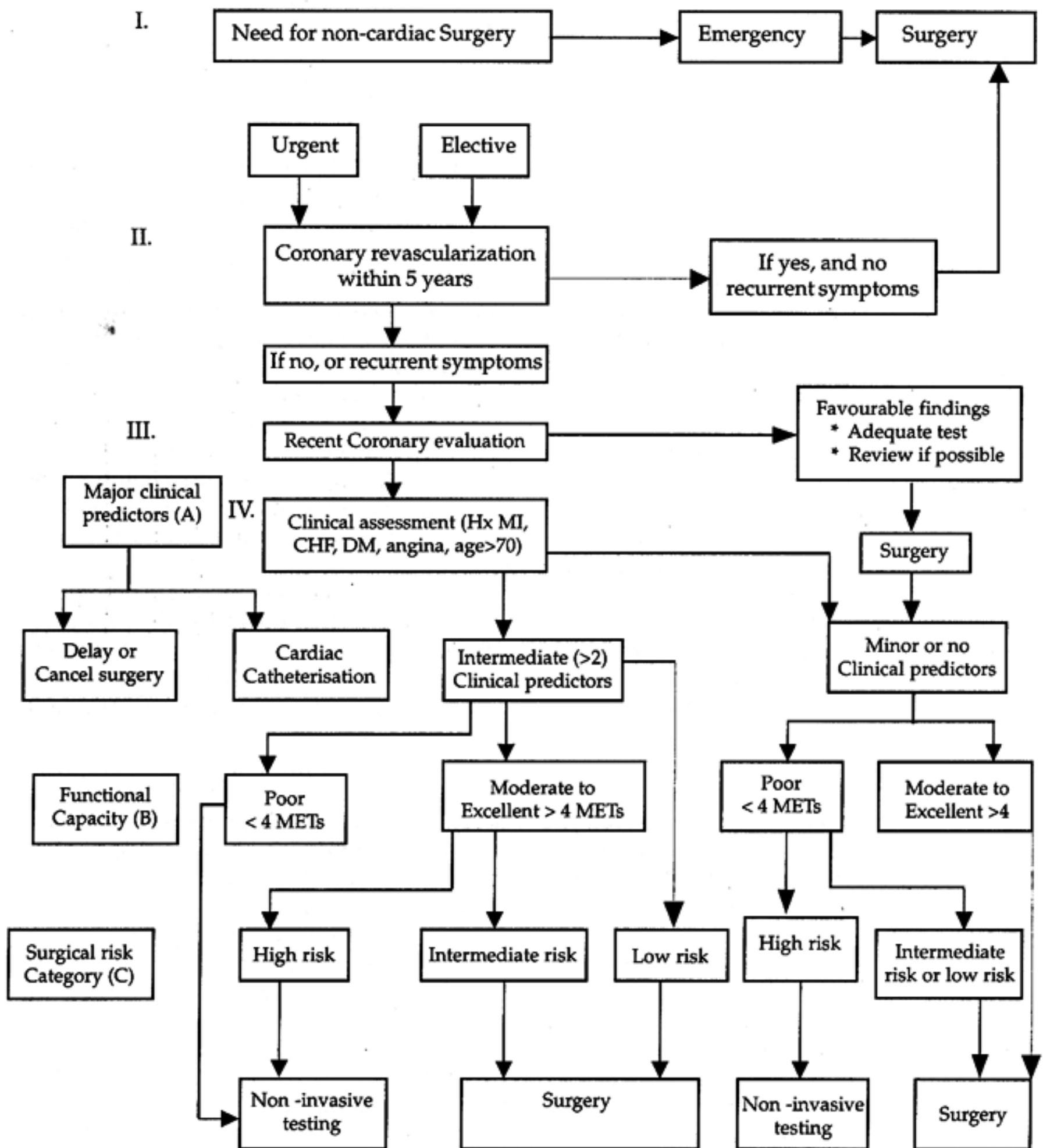
The much discussed Bypass Angioplasty Revascularization Investigation (BARI) has also reported low rates of cardiac complications in non-cardiac surgery in patients who had received revascularization procedures in the form of either CABG or multi-vessel coronary angioplasty¹⁰.

However the timing of the elective surgery has shown to be crucially important. Kalnize & colleagues reported high incidence of stent thrombosis, myocardial infarction and death in patients undergoing non cardiac surgery within 2 weeks of stenting¹¹. This may be related to stopping the antiplatelet therapy within the first few weeks of PCI. Above data thus raises the concern about the validity of PCI as a prophylactic procedure prior to elective surgery compared to medical therapy. The situation therefore hangs in balance.

3. Pharmacological Intervention

Adequate beta adrenergic blockade has recently shown to decrease the risk of perioperative complications. Though early data

Algorithm for cardiac risk assessment before Non-Cardiac Surgery.¹² (modified)



Keys: Hx MI, history of myocardial infarction; CHF, congestive heart failure; DM, diabetes mellitus.

did not show much promise, a recent study by Poldermans et al. randomizing high risk patients undergoing major vascular surgery to the beta blocker Bucindolol or placebo demonstrated a significant reduction in fatal and non fatal cardiac events in the beta blocker treated group compared to placebo¹³.

These patients received Beta Blocker few weeks prior to surgery and the optimal beta blockade aimed at keeping the Heart rate just around 60 beats per minute. Some workers have studied the effect of alpha-receptor agonists in the perioperative period on the incidence of cardiac events. In a large randomized control trial Oliver et al. used Intravenous (I.V) alpha agonists Mivazerol during surgery. They found no significant difference in the two groups in general but a significant difference in cardiac events & death in patients undergoing vascular surgery¹⁴. These studies combined with previous findings show a protective effect of beta blockers on rest or ambulatory myocardial ischaemia and support the hypothesis that perioperative beta blockade has a definite protective role in high risk patients.

Although further data on the subject is required it is quite reasonable to adhere to American College of Cardiology (ACC)/American Heart Association (AHA) guidelines to assess risk¹² and consider beta-blockers for any patient at increased risk not already taking them.

CONCLUSION AND RECOMMENDATIONS

The recent advances have made it possible to have a safe and effective evaluation of patients with known or suspected heart disease undergoing non-cardiac surgery. Non-invasive testing has played a major role in the identification of high-risk patients going for surgical procedures other than cardiac surgery.

The ACC/AHA guidelines are useful method of pre operative evaluation of cardiac risk¹². The ACC/AHA guidelines have three main components:

- a. Clinical evaluation to determine patient's likelihood of significant CAD and perioperative cardiac events.
- b. Selective use of non-invasive testing to identify the risk category.
- c. Interventions to modify cardiac risk.

The following algorithm outlines the approach in a somewhat simple & modified manner. The first step of course is to establish the urgency of the planned surgery. Emergency surgery often life saving in any case should be carried with out delay. Any surgical procedure short of emergency should allow time for cardiac evaluation as outlined. The striking feature of this algorithm is not to rely on testing but to incorporate clinical evaluation with objective testing to define cardiac risk. By adopting the above approach in whatever modified manner perioperative risks can be reduced to a great extent.

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