J Med Sci 2007;27(4):147-152
http://jms.ndmctsgh.edu.tw/2704147.pdf

Latest Recommendations on Perioperative Cardiac Investigations and Use of β Adrenergic Blocking Agents

Ron Olson*

Department of Community and Family Medicine, Department of Anesthesiology, Duke University Medical Center, U.S.A.

This review discusses what cardiac investigations and interventions are indicated before surgery. There are three questions, the answers to which will usually determine the necessity for further preoperative cardiac testing in elective surgery. 1) Does the patient have poor exercise tolerance? 2) Does the patient have two or more unoptimized risk factors for coronary artery disease? 3) Is the surgery high risk? If the answer to two or more of these questions is yes, then further cardiac testing is appropriate. If none or only one is positive, further testing can be postponed until after surgery. This is especially true if beta blockers or other cardioprotective medications are prescribed. The evidence that perioperative beta blockers reduce perioperative risk is not appearing to be as strong as initially presented. Beta blockers should be used where indicated whether or not surgery in planned, and above all, must not be stopped.

Key words: Cardiac investigation, preoperative care, beta adrenergic blockade

Preoperative assessment has traditionally been a time to ensure complete optimization of a patient's health. All the resources of the health system were applied to reduce the high risk associated with surgery and anesthesia. More and more however, surgery and anesthesia have minimal risk, and time for health optimization is limited. Now the decision is not, "Can this patient be possibly made any better?" but rather "Is this patient stable enough to get through this surgery?"

Who should decide whether a patient is ready for surgery/anesthesia–the surgeon, cardiologist, primary care physician, or the anesthesiologist? Often it is a cardiologist, but the cardiologist may not be in the best position to make this decision. The cardiologist may not know the urgency or risk of the surgery, how the patient perceives risk, or the specific skills of the surgeon and the anesthesiologist. Thus in many ways, the attending anesthesiologist is in the best position to make these decisions! This presentation will review what is involved in this preoperative assessment and optimization.

Received: September 12, 2006; Revised: October 30, 2006; Accepted: November 1, 2006
*Corresponding author: Ron Olson, Assistant Clinical Professor, Department of Community and Family Medicine, Department of Anesthesiology, Duke University Medical Center, Durham, NC 27710, USA. Communicated by Chih-Shung Wong

Preoperative Testing Should be Limited

Usually the clinical exam provides enough information for most decisions. While sometimes extra investigations or consultations are required, it is often advantageous to keep patients off what might be called the "Cardiac Stent Express Train". This is the situation where a patient "at risk" for coronary heart disease undergoes a stress echocardiogram which is mildly abnormal and requires angiography for clarification. The angiography shows a lesion amenable to stenting, so a drug eluting stand is placed. Now, the patent is committed to staying on clopidogrel, and cannot get off this "Stent Express" in order to have surgery for several weeks. This is especially troublesome if surgery was more necessary in the short or medium term than the stent placement.

This is one example of the principle that it is important not to order tests unless there is a good clinical reason to do so. Especially in the perioperative period of low or medium risk surgery, it is best to avoid tests which will not impact on the perioperative period. Positive test results in a low risk population are almost always false positives. False positives delay surgery unnecessarily, create patient anxiety, and generally require further tests. These further tests can be expensive, inconvenient, painful, and even dangerous. False negatives are less common, but may create a false sense of security which leads a clinician to ignore clinical signs of trouble.

Sometimes tests are ordered because they are perceived to provide evidence of clinical prudence. It is hoped that

having ordered tests may protect a clinician from litigation in case of a bad outcome. But most clinicians are aware of the previously described low positive predictive value of a positive test in an asymptomatic individual. They thus intuitively (and correctly) ignore unexpected mildly abnormal results. Unfortunately, lawyers may attribute any subsequent bad outcome to the lack of follow up of the abnormality. There is now more risk of litigation from lack of follow up of even mild abnormalities, than from not ordering an unnecessary test.

Searching for asymptomatic disease is "screening", and there are several authoritative organizations which devote considerable thought into determining when screening for conditions such as diabetes, lung cancer, or bleeding abnormalities are appropriate. The perioperative period of low risk surgery is rarely one of these situations.

When Are Preoperative Cardiac Tests Really Needed?

So when are preoperative tests, such as cardiac investigations, indicated? One guideline which has been widely used is the American College of Cardiology/American Heart Association 2002 Guideline Update on Perioperative Cardiovascular Evaluation for Noncardiac Surgery[1]. A simplification of these guidelines with modification is presented here. The modifications are consistent with a recent update of the guidelines[2].

There are three questions, the answers to which will usually determine the necessity for further preoperative cardiac testing in elective surgery. 1) Does the patient have poor exercise tolerance? 2) Does the patient have two or more unoptimized risk factors for coronary artery disease? 3) Is the surgery high risk? If the answer to 2 or more of these questions is yes, then further cardiac testing such as dobutamine stress echocardiography or adenosine nuclear scanning is appropriate (Fig. 1). If none or only one is positive, further testing can be postponed until after surgery. This is especially true if beta blockers or other cardio protective medications are prescribed.

1. Exercise Tolerance

Exercise tolerance is a surprisingly simple yet valuable discriminator of risk[3]. If a patient can climb two flights of stairs without significant dyspnea, he or she has demonstrated a cardiopulmonary reserve adequate to cope with the stress of most surgery.

2. Presence of Risk Factors

The ACC/AHA guidelines describe three categories of clinical indicators of cardiac risk[1]. The major clinical

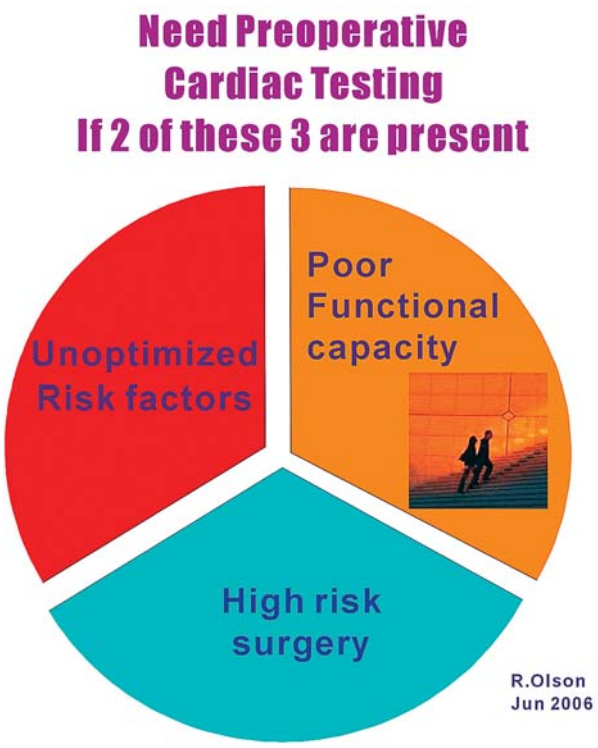

Fig. 1 Three questions to determine the necessity for further preoperative cardiac testing in elective surgery

indicators are decompensated CHF, unstable coronary syndromes, significant arrhythmias, and severe valvular disease. These are unstable conditions where there is no controversy over the need to address them before surgery.

Minor clinical indicators are age, abnormal ECG (except for acute ischemia), rhythm other than sinus, uncontrolled hypertension, or history of stroke. With the exception of history of stroke, none of these have not been shown to significantly increase perioperative risk. There is little evidence that hypertension matters perioperatively but it is the most common modifiable cause of cardiac death and is a marvelous excuse to start β blockers which may provide perioperative as well as life long cardioprotection. This will be discussed further below.

Intermediate clinical indicators are the factors which really determine if cardiac testing is needed. They are a history of CHF, history of MI, mild angina, diabetes, or renal insufficiency. If optimized (stable), these generally do not significantly increase anesthetic risk, but if not optimized, they may increase risk, and should be addressed. The original ACC/AHA document suggests presence of one of these intermediate clinical risk factors warrants consideration of preoperative testing[1]. A more practical and still safe approach is to only consider extra testing if

there are two of these which have not been optimized (as well as one of poor exercise tolerance and high risk surgery).

3. High risk surgery

Many surgical procedures to not cause physiological stress any greater than the activities of daily living. Thus, even if patient has either poor functional capacity, or unoptimized risk factors (but not both), low or moderate risk surgery can usually proceed without further investigations. Schein's study of 19,557 cataract surgery cases is often referenced as evidence of this[4]. It is important however to rote that all patents in that study were seen by their primary care physician, and any obvious health issues were addressed. Therefore, even though it is unlikely that special cardiac testing is needed before low risk surgery, someone does need to do a basic history and physical. Even in "high tech" medicine, there is no substitute for listening to the patient.

High risk surgery, which may warrant testing if the response to one of the first two questions is positive, is defined as prolonged surgery, especially in the thorax or abdomen, and vascular surgery with the probable exception of carotid endarterectomy[1].

The general requirement that the presence of two or more of these three conditions warrants cardiac investigation may be mitigated if beta blockers are prescribed, as this may be the best treatment regardless of what cardiac investigations reveal[5]. Beta blockers are recommended therapy for all patients with cardiac disease[6], hypertension[7], peripheral vascular disease[8], and congestive heart failure[9]. Diabetes[10], chronic obstructive pulmonary disease[11], and asthma[12] are not contraindications to beta blockers.

Having said that, the evidence that perioperative β blockers reduce perioperative risk is not appearing to be as strong as initially presented[13,14]. The major evidence which made this therapy popular, two studies by Mangano[15] and Poldermans[16], represent only 41 adverse outcomes among 304 study patients. A meta analysis of all eight randomized studies of this topic showed that they only comprise a total of 83 adverse events in 1152 patients[17]. In a recent retrospective cohort study of 663,635 patients undergoing major noncardiac surgery, administration of perioperative beta blockers was associated with no benefit and possible harm in patients with zero or one risk factor for cardiac morbidity[18].

It is possible that the small perioperative benefit in low risk patients is outweighed by the adverse effects of discontinuing beta blockers. Perhaps the most important part of perioperatively beta blocker therapy is that it must not be inadvertently stopped. The rebound effect of this is quite detrimental.

Another potential reason for the limited efficacy of beta blockers is that there are two separate mechanisms for perioperative MIs. One is the classic supply/demand mismatch occurring at a critical stenosis of a coronary artery. The other is endothelial dysfunction causing a sudden rupture of a vulnerable plaque on an often non critical lesion. Beta blockers are likely protective of the first etiology but not the second. Statins are likely the best therapy to control the second mechanism.

As a result of these reevaluations, the 2006 ACC/AHA Update has adjusted the guidelines. The recommendation for use of perioperative β blockers remains strong for patients undergoing major vascular surgery who have ischemia, and for those patients already on beta blockers for other clear indications. There is however a slight softening of other recommendations. Beta blockers are *probably recommended* for patients undergoing vascular surgery in whom preoperative assessment identifies coronary heart disease, or who have multiple risk factors for CHD. They are *probably recommended* for patients undergoing intermediate or high risk procedures who have CHD or multiple risk factors for CHD. They *may be considered* for patients who are undergoing intermediate- or high-risk procedures, including vascular surgery, in whom preoperative assessment identifies intermediate cardiac risk as defined by the presence of a single clinical risk factor2. Thus there is need for clinical judgment in prescribing perioperative beta blockers in lower risk patients.

Further information on the perspective use of beta blockers should come from the PeriOperative ISchemic Evaluation (POISE) Trial. It is an international randomized controlled trial of metoprolol versus placebo in 10,000 patients undergoing noncardiac surgery. So far about 6000 patients have been enrolled. The results of another study of the perioperative use of beta blockers in diabetics is likewise eagerly anticipated.

In summary, whether or not preoperative cardiac investigations are necessary can be determined by three factors easily assessed by the anesthesiologist. Perioperative beta blockers should be used where appropriate, and above all, not be stopped.

REFERENCES

1. Eagle KA, Berger PB, Calkins H, Chaitman BR, Ewy GA, Fleischmann KE, Fleisher LA, Froehlich JB, Gusberg RJ, Leppo JA, Ryan T, Schlant RC, Winters WL Jr, Gibbons RJ, Antman EM, Alpert JS, Faxon DP,

Fuster V, Gregoratos G, Jacobs AK, Hiratzka LF, Russell RO, Smith SC Jr. ACC/AHA Guideline Update for Perioperative Cardiovascular Evaluation for Noncardiac Surgery–Executive Summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). Anesth Analg 2002;94:1052-64.

2. American College of Cardiology. American Heart Association Task Force on Practice Guidelines (Writing Committee to Update the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). American Society of Echocardiography. American Society of Nuclear Cardiology. Heart Rhythm Society. Society of Cardiovascular Anesthesiologists. Society for Cardiovascular Angiography and Interventions. Society for Vascular Medicine and Biology. Fleisher LA, Beckman JA, Brown KA, Calkins H, Chaikof E, Fleischmann KE, Freeman WK, Froehlich JB, Kasper EK, Kersten JR, Riegel B, Robb JF, Smith SC Jr, Jacobs AK, Adams CD, Anderson JL, Antman EM, Faxon DP, Fuster V, Halperin JL, Hiratzka LF, Hunt SA, Lytle BW, Nishimura R, Page RL, Riegel B. ACC/AHA 2006 Guideline Update on Perioperative Cardiovascular Evaluation for Noncardiac Surgery. J Am Coll Cardiol 2006;47:2343-55.
3. Reilly DF, McNeely MJ, Doerner D, Greenberg DL, Staiger TO, Geist MJ, Vedovatti PA, Coffey JE, Mora MW, Johnson TR, Guray ED, Van Norman GA, Fihn SD. Self-reported Exercise Tolerance and the Risk of Serious Perioperative Complications. Arch Intern Med 1999;159:2185-2192.
4. Schein OD, Katz J, Bass EB, Tielsch JM, Lubomski LH, Feldman MA, Petty BG, Steinberg EP. The value of routine preoperative medical testing before cataract surgery. Study of Medical Testing for Cataract Surgery. New Engl J Med 2000;342:168-175.
5. Boersma E, Poldermans D, Bax JJ, Steyerberg EW, Thomson IR, Banga JD, van De Ven LL, van Urk H, Roelandt JR, Group DS. Predictors of cardiac events after major vascular surgery: Role of clinical characteristics, dobutamine echocardiography, and beta-blocker therapy. JAMA 2001;285:1865-73.
6. Smith SC, Jr., Allen J, Blair SN, Bonow RO, Brass LM, Fonarow GC, Grundy SM, Hiratzka L, Jones D, Krumholz HM, Mosca L, Pasternak RC, Pearson T, Pfeffer MA, Taubert KA. AHA/ACC Guidelines for Secondary Prevention for Patients With Coronary and Other Atherosclerotic Vascular Disease. Circulation 2006;113:2363-2372.
7. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, Jr., Jones DW, Materson BJ, Oparil S, Wright JT, Jr., Roccella EJ. Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension 2003;42:1206-1252.
8. Hirsch AT, Haskal ZJ, Hertzer NR, Bakal CW, Creager MA, Halperin JL, Hiratzka LF, Murphy WR, Olin JW, Puschett JB, Rosenfield KA, Sacks D, Stanley JC, Taylor LM Jr, White CJ, White J, White RA, Antman EM, Smith SC Jr, Adams CD, Anderson JL, Faxon DP, Fuster V, Gibbons RJ, Hunt SA, Jacobs AK, Nishimura R, Ornato JP, Page RL, Riegel B. American Association for Vascular Surgery. Society for Vascular Surgery. Society for Cardiovascular Angiography and Interventions. Society for Vascular Medicine and Biology. Society of Interventional Radiology. ACC/AHA Task Force on Practice Guidelines Writing Committee to Develop Guidelines for the Management of Patients With Peripheral Arterial Disease. American Association of Cardiovascular and Pulmonary Rehabilitation. National Heart, Lung, and Blood Institute. Society for Vascular Nursing. TransAtlantic Inter-Society Consensus. Vascular Disease Foundation. ACC/AHA 2005 Practice Guidelines for the Management of Patients With Peripheral Arterial Disease. Circulation 2006;113:463-654.
9. Hunt SA, Abraham WT, Chin MH, Feldman AM, Francis GS, Ganiats TG, Jessup M, Konstam MA, Mancini DM, Michl K, Oates JA, Rahko PS, Silver MA, Stevenson LW, Yancy CW, Antman EM, Smith SC, Jr., Adams CD, Anderson JL, Faxon DP, Fuster V, Halperin JL, Hiratzka LF, Hunt SA, Jacobs AK, Nishimura R, Ornato JP, Page RL, Riegel B. ACC/AHA 2005 Guideline Update for the Diagnosis and Management of Chronic Heart Failure in the Adult. Circulation 2005;112:154-235.
10. American Diabetes Association. Standards of Medical Care in Diabetes-2006. Diabetes Care 2006;29:4-42.
11. Salpeter SR, Ormiston TM, Salpeter EE, Poole PJ, Cates CJ. Cardioselective beta-blockers for chronic obstructive pulmonary disease: a meta-analysis. Resp Med 2003;97:1094-101.
12. Salpeter SR, Ormiston TM, Salpeter EE. Cardioselective beta-blockers in patients with reactive airway disease: a meta-analysis. Ann Intern Med 2002; 137: 715-25.
13. Brady AR, Gibbs JS, Greenhalgh RM, Powell JT, Sydes MR, POBBLE trial investigators. Perioperative

beta-blockade (POBBLE) for patients undergoing infrarenal vascular surgery: results of a randomized double-blind controlled trial. J Vasc Surg 2005;41: 602-9.

14. Juul AB, Wetterslev J, Gluud C, Kofoed-Enevoldsen A, Jensen G, Callesen T, Norgaard P, Fruergaard K, Bestle M, Vedelsdal R, Miran A, Jacobsen J, Roed J, Mortensen MB, Jorgensen L, Jorgensen J, Rovsing ML, Petersen PL, Pott F, Haas M, Albret R, Nielsen LL, Johansson G, Stjernholm P, Molgaard Y, Foss NB, Elkjaer J, Dehlie B, Boysen K, Zaric D, Munksgaard A, Madsen JB, Oberg B, Khanykin B, Blemmer T, Yndgaard S, Perko G, Wang LP, Winkel P, Hilden J, Jensen P, Salas N, DIPOM Trial Group. Effect of perioperative beta blockade in patients with diabetes undergoing major non-cardiac surgery: randomised placebo controlled, blinded multicentre trial. Brit Med J 2006;332:1482.
15. Mangano DT, Layug EL, Wallace A, Tateo I. The Multicenter Study of Perioperative Ischemia Research G: Effect of Atenolol on Mortality and Cardiovascular Morbidity after Noncardiac Surgery. N Engl J Med 1996;335:1713-1721.
16. Poldermans D, Boersma E, Bax JJ, Thomson IR, van de Ven LLM, Blankensteijn JD, Baars HF, Yo T-I, Trocino G, Vigna C, Roelandt JRTC, van Urk H, Fioretti PM, Paelinck B. The Effect of Bisoprolol on Perioperative Mortality and Myocardial Infarction in High-Risk Patients Undergoing Vascular Surgery. N Engl J Med 1999;341:1789-1794.
17. Devereaux PJ, Beattie WS, Choi PT-L, Badner NH, Guyatt GH, Villar JC, Cinà CS, Yusuf S. How strong is the evidence for the use of perioperative beta blockers in non-cardiac surgery? Brit Med J 2005:1-9.
18. Lindenauer P, Pekow P, Wang K, Mamidi D, Gutierrez B, Benjamin E. Perioperative Beta-Blocker Therapy and Mortality after Major Noncardiac Surgery. N Engl J Med 2005;353:349-61.