Title: PROLONGED POSTOPERATIVE MYOCARDIAL ISCHEMIA IN HIGH-RISK PATIENTS UNDERGOING NON-CARDIAC SURGERY

Authors: M.G. Wong, B.S., Y.C. Wellington, M.S., M.J. London, M.D., E. Layug, M.D., J. Li, M.D., D.T. Mangano, Ph.D., M.D.

Affiliation: Department of Anesthesiology, University of California, San Francisco, 94143, and San Francisco Veterans Administration Medical Center, 94121

Introduction. Knight has recently demonstrated that postoperative electrocardiographic (ECG) ischemia is more common than intraoperative ischemia following coronary artery bypass graft surgery (1). In addition, postoperative ischemia was more severe in magnitude and duration. Thus, the postoperative period appears to be critical. Little is known, however, about the much larger population of high risk patients undergoing non-cardiac surgery. To rigorously characterize postoperative ischemia in this population, we measured the incidence, severity, supply/demand relationships and time course of ECG ischemia continuously throughout the first week following surgery.

Methods. 102 male patients, having two or more risk factors or documented coronary artery disease (CAD), were studied following non-cardiac surgery under general anesthesia. Informed consent and approval were obtained. Beginning one hour after end of surgery, patients were continuously monitored for 6.1 (±2.6) days (total = 10,773 hours). A single-channel real time ECG recorder (QMED Monitor One Star) was used and lead CM5 was selected (2). The effect of positional variation on ECG morphology was measured prior to study in the supine, left lateral decubitus, right lateral decubitus, and upright positions. The baseline ST-segment level was chosen as the most depressed ST-segment of the positional tracings, and the monitor's programmable ST-segment threshhold was set at >0.1mV below baseline. ECG changes consistent with ischemia were defined as reversible deviations from baseline >0.1mV at J + 60msec lasting at least one minute. Significant T-wave changes were defined as symmetrical inversion of an upright T-wave or >50% deepening of the amplitude of an inverted T wave. Only those reported ECG changes accompanied by hard copy were considered for analysis. Two independent observers reviewed and verified all ST-segment and T-wave changes from the ECG tracings.

Results. ST changes were detected in 28 (27%) patients. Significant T-wave changes were detected in 7% of the patients. A total of 312 episodes of ST-segment depression were identified. The pattern of the postoperative ECG changes is shown in Figure 1. 96% of ischemic patients had early ischemia [postoperative day 0 to 3 (POD 0 to 3)]; 43% of ischemic patients had late ischemia (POD4 to POD10). The charactericstics of these episodes are shown in the table. 64% of all ST-segment depression episodes were associated with tachycardia (heart rate≥100bpm). 82% of the ischemic ST episodes occurred without symptoms (chest pain, dyspnea). No difference in the incidence of ischemic ST-depression was found in patients with CAD (25%) compared to patients with two or more risk factors (30%). Cardiac outcomes (death, infarction, failure) occured in 8 patients (8%). 6/8 patients had ischemic ST-depression. 4/12 patients with late postoperative ischemia had cardiac outcomes. The one postoperative infarct occurred on POD4, with the patient exhibiting progressively worsening ST-depression on POD1 through POD3 that was not detected by routine daily 12-lead ECG (Figure 2).

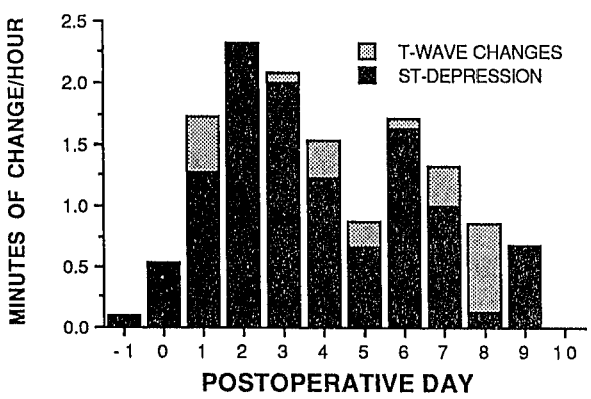
Discussion. The results of this study suggest: (1) Time Course- postoperative ECG ischemia occurs in approximately 30% of high-risk patients throughout the first week following non-cardiac surgery, (2) Patient Characteristics- patients with manifest CAD were no more likely to have postoperative ECG ischemia than patients with risk factors, nor was their ischemia more severe, (3) Detection- clinical detection of postoperative ECG ischemia is difficult because of its silent nature, (4) Therapy- stricter control of heart rate (pain control, beta blockers) may be necessary to reduce the large proportion of demand-related ischemia, and (5) Outcome- late postoperative ischemia may be a risk factor for cardiac outcomes.

Thus, prolonged ECG monitoring of selected high-risk patients and aggressive heart rate control may be important throughout the postoperative period.

References:

1) Knight A, et al : Perioperative Myocardial Ischemia: Importance of the Preoperative Ischemic Pattern. (ANESTHESIOLOGY : In Press)
2) Barry J, et al : Ambulatory Monitoring of the Digitized Electrocardiogram for Detection and Early Warning of Transient Myocardial Ischemia in Angina Pectoris. AM J CARDIOL 60:483-488, 1987

Figure 1



POSTOPERATIVE ISCHEMIA CHARACTERISTICS

	HRS. MON.	%PTS. ST DEP.	# OF ↓ST	MINUTES ↓ST	% ↓ST HR>100	% ↓ST: SYMPTOMS	T-WAVE CHANGES
PREOP	208	4	3	20	100	0	0
DOS	817	6	15	440	40	0	0
POD1	2004	17	58	2563	64	0	8
POD2	1775	16	59	4130	76	0	0
POD3	1538	17	73	3085	67	27	9
POD4	1277	19	24	1575	33	8	19
POD5	1051	10	14	690	36	0	13
POD6	1011	15	42	1645	80	67	7
POD7	728	15	18	730	39	28	12
POD8	296	8	5	40	80	0	9
POD9	29	33	1	20	100	0	0
POD10	5	0	0	0	0	0	0

Figure 2

CM5 changes prior to POD 4 myocardial infarction.