

Re-exploration for Bleeding after Coronary Artery Bypass Grafting. What is the Acceptable Range of Re-exploration Rate?

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To the Editor:

I read with interest the article published in the *Annals of Thoracic and Cardiovascular Surgery*, entitled "Re-exploration for hemorrhage following open heart surgery differentiation on the causes of bleeding and impact on patient outcomes" reported by the University of California, San Francisco and the Robert Wood Johnson Medical School.¹ They reported that the postoperative exploration rate due to bleeding after coronary artery bypass grafting (CABG) was 3.6% and that among them 66% were surgical bleeding. Their major bleeding sources were from the graft (39%) and from the chest wall (34.5%). The Society of Thoracic Surgeons published the annual complication rates and reported average re-exploration rate for postoperative bleeding was 3.1%.² However, only a few reports mentioned surgical bleeding; thus, the report by Dr. Hall is important.

In our practice, we performed a total of 2,577 CABG between 1990 and 2001 at Shin-Tokyo and Kobari General Hospital, and there were 17 incidences of re-exploration for bleeding (0.7%). Our criteria for re-exploration was similar to Dr. Hall's report: drainage more than 200 ml/hour after activating clotting time was adequately controlled. In our practice, hypothermia during the cardiopulmonary bypass was only performed for patients whom required circulatory arrest and cardiopulmonary bypass was usually allowed to run at 36°C (normothermia), since we are concerned about coagulation anomalies which occur with hypothermia. Among the 17 incidences of bleeding, bleeding from the chest wall comprised the majority of causes (14/17, 82.5%). Bleeding from the chest wall occurred due to inappropriate hemostasis of the internal mammary vessels and its branches. We have experienced only 3 incidences (17.6%) of bleed-

ing from the graft. The recovery of the patients who required re-exploration for bleeding was slower than the control group. Intubation time (33.1±40.6 hours in the bleeding group vs. 11.5±21.8 hours in the control group, $p<0.05$), ICU stay (6.1±6.6 days vs. 2.9±3.0 days, $p<0.0001$) and postoperative stay (22.6±8.1 days vs. 17.0±11.2 days, $p<0.005$) were significantly longer than the control group (Table 1). However, the incidences of major complications occurring in the bleeding group were not significantly different from the control group. Postoperative bleeding had no impact on the postoperative deaths in our series.

I have several questions for the authors. First, I would like to know why so many incidences of surgical bleeding occurred in their practice. Graft bleeding is a serious concern, because it may result in postoperative myocardial infarction or low output syndrome. I also would like to ask Dr. Hall what precautions to prevent bleeding from the graft were performed. Over the 5-year period, have they changed any surgical methods, aiming to decrease the incidences of postoperative bleeding? Second, the authors concluded that postoperative bleeding was associated with postoperative mortality and morbidity, but I could see no multivariate logistic analysis in their article. I am not sure postoperative bleeding was the only predictor of mortality or morbidity in their series. Third, which bleeding was related with mortality and morbidity, surgical bleeding, medical bleeding, or both? Could the mortality and morbidity be decreased, if bleeding from the graft was adequately controlled?

Since the incidence of bleeding reported by Dr. Hall was more than 4 times higher than our results, we would be interested in this information.

References

1. Hall TS, Brevetti GR, Skoultchi AJ, Sines JC, Gregory P, Spotnitz AJ. Re-exploration for hemorrhage following open heart surgery differentiation on the causes of bleeding and impact on patient outcomes. *Ann Thorac Cardiovasc Surg* 2001; 7: 352–357.
2. Available from web site: <http://www.sts.org/>. STS National Database, Adult Cardiac Surgery Section.

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Table 1. Surgical results of bleeding and control patients

	Bleeding group (n=17)		Control group (n=2,560)		p
Number of distal anastomosis	2.6±1.4	(1-5)	3.2±1.2	(1-8)	NS
Isolated CABG	10	58.8%	2,148	83.9%	<0.01
Valvular or ventricular surgery	8	47.1%	261	10.2%	<0.0001
Redo CABG	1	5.9%	74	2.9%	NS
Bilateral internal mammary artery use	2	11.8%	692	27.0%	NS
Clamp time (minutes)	84.0±35.3	(41-155)	74.2±34.6	(8-292)	NS
Pump time (minutes)	136.1±63.2	(69-290)	111.3±48.2	(11-443)	NS
Intubation (hours)	33.1±40.6	(5-144)	11.5±21.8	(0-338)	<0.05
ICU stay (days)	61±6.6	(1-28)	2.9±3.0	(0-60)	<0.0001
Postoperative stay (days)	22.6±8.1	(8-48)	17.0±11.2	(3-175)	<0.005
Postoperative major complications					
Low output syndrome	1	5.9%	56	2.2%	NS
Postoperative myocardial infarction	0	0.0%	29	1.1%	NS
Respiratory failure	2	11.8%	134	5.2%	NS
Pneumonia	1	5.9%	47	1.8%	NS
Severe arrhythmia	1	5.9%	39	1.5%	NS
Cerebral vascular accident	0	0.0%	54	2.1%	NS
Re-exploration for bleeding	17	100.0%	0	0.0%	
Postoperative hemodialysis	1	5.9%	34	1.3%	NS
Mediastinitis	0	0.0%	24	0.9%	NS
Inhospital death	1	5.9%	29	1.1%	NS

Statistical analysis was performed using the Student's t-tests or Mann-Whitney's u-tests as appropriate for continuous variables, or chi-square tests (Fisher's exact tests if n<5) for categorical variables. A p-value less than 0.05 was considered significant.

Reply:

My congratulations to Dr. Hirose and his group, their results obviously reflect careful surgical technique and conscientiousness. The results we have reported reflect the efforts of 5 different surgeons within one system that reflects a relatively low rate for re-exploration when compared to the literature cited in the article. The variance in these rates reflect not only the surgical skill of the operating surgeons but the co-morbidities of the patient population, the regional exposure to anticoagulant and antiplatelet agents and the surgeons propensity for re-exploration. Older sicker patients on low molecular weight heparin and clopidogrel are more likely to be explored and to have side branch bleeding when exposed to cardiopulmonary bypass than younger elective patients in which these medications can be curtailed prior to surgery.

Awareness is the most important precaution that surgeons need to take to avoid the negative impact on patient outcomes from postoperative hemorrhage. Appreciation of the impact of this complication should encourage the appropriate preoperative preparation of the patients and early postoperative management. A clear change in technique directly related to this problem is the wider application of "off-pump" coronary bypass surgery. This approach has been shown in our studies and others to decrease overall bleeding and re-exploration, particularly

in the more medically compromised and unstable patients.

Part of the reason for not performing multivariate analysis in this group was related to the outcome related grouping. With a study of this magnitude, the outcome related data shows a significance that denotes an important association. However there is no doubt that multiple other factors such as age, type of procedure, case urgency, liver function, heart failure and preoperative anticoagulant exposure are critical risk factors for postoperative bleeding. Because of the heterogeneity of this group and the additional risk factors that were not part of the original model, we felt this group might yield inappropriate associations and invalid information despite extensive multivariate modeling.

As noted in our publication, appreciation of this problem and the associated impact on outcomes has led to more aggressive management practices both in the operating room and in the ICU leading to a minimization of the impact of bleeding postoperatively. Seventy percent of our coronary bypass cases are now performed without cardiopulmonary bypass support with the expected reduction in postoperative bleeding and complications.

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