

Predictors of Gastrointestinal Perforation in Patients Undergoing Coronary Artery Bypass Graft (CABG) Surgery in Tehran, Iran

Nouredin Alebouyeh, MD, Mehrdad Toefigh, MD, Nima Ghasemzadeh, MD, Samineh Mirheydari, MD, and Ezonollah Azargashb, PhD

Background: Gastrointestinal perforation after coronary artery bypass graft (CABG) surgery is often difficult to diagnose and is associated with high morbidity and mortality rates. The aim of this study was to determine risk factors for this complication in the studied population to further improve prophylaxis and diagnosis in the region of study.

Methods: Of 8,975 consecutive patients undergoing CABG during 10 years (1995–2005), 15 (0.16%) developed gastrointestinal perforation requiring laparotomy. Data from patients who experienced gastrointestinal perforation were analyzed using univariate tests in a controlled retrospective design.

Results: Prolonged bypass time and preoperative heparin administration were found to be significant ($P < 0.05$) risk factors.

Conclusion: Low splanchnic blood flow and vasoconstriction might be underlying factors associated with both predictors. With current findings, however, clear inference about preoperative and postoperative predictors and their relation is not possible. With more information, the next step would be to build a prediction model in recognition of gastrointestinal perforation after CABG on the basis of the predisposing factors. (*Ann Thorac Cardiovasc Surg* 2007; 13: 251–253)

Key words: coronary artery bypass graft, gastrointestinal complications, gastrointestinal perforation, Iran

Introduction

The gastrointestinal complications (GICs) after coronary artery bypass graft (CABG) surgery are often difficult to diagnose and are associated with high mortality and morbidity rates.^{1–10} Moreover, the incidence of GICs increases hospital costs resulting from specific treatments such as intravenous fluid replacement, blood transfusion, and endoscopic ablation and/or clipping.¹¹ Thus an early diagnosis of GICs following CABG is of immense importance.

From School of Medicine, Shahid Beheshti University of Medical Sciences and Health Care, Tehran, Iran

Received October 20, 2006; accepted for publication October 26, 2006

Address reprint requests to Nouredin Alebouyeh, MD: Apt.808, 18 Hillcrest Ave., North York, ON, Canada.

The clinician should suspect GICs in any patient with abdominal pain and tenderness following CABG. Accordingly, several authors have suggested resuming a low threshold for proceeding to exploratory laparotomy for early recognition of these complications, which commonly include gastroduodenal ulcer, enterocolitis, and ischemic colitis.^{12–14}

Gastrointestinal perforation (GIP) is an uncommon GIC after CABG. Despite our knowledge of the risk factors involved in the development of major GICs after CABG, literature on the identification of the risk factors associated with GIP contains little information about it.

The present work was initiated as a regional-level study with the aim of determining independent risk factors associated with the development of GIP after CABG in the population of patients in Tehran, Iran.

Table 1. Comparison variables representing preoperative conditions and operative/postoperative factors between the two groups

	GIP (n=15)	Control (n=30)	Statistics	P-value	95% CI
Preoperative					
Age+	57.7±6.7	55.8±10.2	NS	0.52	-4.0-7.8
Gender (male/female)	8/7	13/17	NS	0.75	
Weight	68.2±8.9	70.4±9.7	NS	0.48	-8.2-3.9
DM	7 (46.6%)	7 (23.3%)	NS	0.17	
HTN	6 (40%)	16 (53.3%)	NS	0.59	
Hypercholesterolemia	4 (26.6%)	11 (36.6%)	NS	0.73	
Smoking	9 (60%)	10 (33.3%)	NS	0.16	
PVD	3 (20%)	10 (33.3%)	NS	0.49	
MI <30 days	6 (40%)	5 (16.6%)	NS	0.14	
NYHA III-IV	9 (60%)	16 (53.3%)	NS	0.91	
EF <40%	9 (60%)	15 (50%)	NS	0.75	
Heparin	10 (66.6%)	8 (26.6%)		0.02*	
COPD	4 (26.6%)	6 (20%)	NS	0.71	
PU	1 (6.6%)	5 (16.6%)	NS	0.64	
Operative/postoperative					
No. of ANAS+	2.6±0.6	2.5±0.6	NS	0.72	-0.3-0.4
BT+	139±18.5	110.5±33.3		0.001*	12.8-44.1
ACT+	60±7.79	54.9±14.7	NS	0.08	-0.83-12.7
PT+	96.4±21.5	86.6±14.7	NS	0.12	-3.0-22
IABP	1 (6.6%)	2 (6.6%)	NS	1.00	
Ventilation >24 h	2 (13.3%)	6 (20%)	NS	0.69	
ICU+ admission	3.53±1.64	3.03±1.54	NS	0.32	-0.5-1.5
Renal failure	3 (20%)	5 (16.6%)	NS	1.00	

GIP, gastrointestinal perforation; DM, diabetes Mellitus; HTN, hypertension; PVD, peripheral vascular disease; MI, myocardial infarction; NYHA, New York Heart Association; EF, ejection fraction; COPD, chronic obstructive pulmonary disease; PU, peptic ulcer; No. of ANAS, number of anastomoses; BT, bypass time; ACT, aortic clamp time; PT, pump time; IABP, intra-aortic balloon pump; ICU, intensive care unit; NS, nonsignificant; 95% CI, 95% confidence interval; continuous data are presented as mean±SD (standard deviation); *, P<0.05.

Methods

The data set comprised information on 8,975 patients who had undergone CABG from January 1995 to August 2005 in Modarress Hospital, one of the two university hospitals to perform CABG in Tehran, Iran. The case group is represented by 15 patients who were reported to have postoperative GIP confirmed by exploratory laparotomy. These 15 patients were compared with 30 patients who had undergone CABG surgery without any GICs in a retrospective matched case-control design. Table 1 lists the variables that were considered possible risk factors. The data for groups were summarized as mean ± SD or as a percentage. Differences between groups were tested for significance with Fisher's exact test for categorical data and *t*-test for continuous data after being tested for the assumption of normal distribution. P values of less than 0.05 (two-tailed) were considered significant.

Results

For patients undergoing CABG with cardiopulmonary bypass, various risk factors were compared between those who developed GIP (case group, GIP, *n*=15) and those who did not (control group, *n*=30). A total of 187 of the patients who underwent CABG surgery had GIC postoperatively. Fifteen were registered as having GIP and peritonitis after exploratory laparotomy (incidence: 0.16%).

The variables representing preoperative conditions and operative/postoperative factors are listed in Table 1. Patients with GIP had significantly prolonged bypass time and preoperative heparin administration (P<0.05). There were nonsignificant differences in other variables between the control and GIP groups.

Discussion

The data set used in this study is assumed to be a fair

representation of the population of interest because Modarress Hospital is the major hospital to perform CABG in the region. The incidence of GIP revealed in this study warrants attention with respect to the overall incidence rate of GICs after CABG (0.3–3.7%).^{1–9)}

The present paper is the first report of risk factors associated with GIP in the studied population. An immediate implication of these findings would therefore be an improvement of prophylaxis and an accuracy of diagnosis by demonstrating the risk factors in the region of study.

Prolonged bypass time and preoperative heparin administration were identified as predictors of GIP after CABG. It is thought that these two predictors are related to low splanchnic blood flow. Another contributing factor might be vasoconstriction, which is often associated with low cardiac output and may be aggravated by the use of vasopressors during extra corporeal circulation in the postoperative period.¹⁵⁾ However, more studies are needed on postoperative and preoperative predictors to confirm and validate the current results.

Although many studies in the literature have investigated risk factors for GICs after CABG,^{10,11,15)} they have not been implicitly concentrated on GIP. The current findings could further be used in building a predictive model for the recognition of GIP after CABG on the basis of the predisposing factors. It should be noted, however, that the variables in this study were defined with respect to the information available on the patients. This information might differ in other regions and might include data such as the history of cerebrovascular accidents, arterial fibrillation, embolic disease (mesenteric, peripheral), alcohol ingestion, prior abdominal operation, endocarditis, sepsis, and reoperation.

References

1. Ohri S, Desai J, Gaer J, et al. Intra-abdominal complications after cardiopulmonary bypass. *Ann Thorac Surg* 1991; **52**: 826–31.
2. Sakorafas G, Tsiotos G. Intra-abdominal complications after cardiac surgery. *Eur J Surg* 1999; **165**: 820–7.
3. Ghosh S, Roberts N, Firmin R, et al. Risk factors for intestinal ischemia in cardiac surgical patients. *Eur J Cardiothorac Surg* 2002; **21**: 411–6.
4. Zacharias A, Schwann T, Parenteau G, et al. Predictors of gastrointestinal complications after cardiac surgery. *Tex Heart Inst J* 2000; **27**: 93–9.
5. Moriyama Y, Toyohira H, Shimokawa S, et al. Gastrointestinal complications after open cardiac operation. *Kyobu Geka* 1993; **46**: 1122–5.
6. Huddy S, Joyce W, Pepper J. Gastrointestinal complications in 4473 patients who underwent cardiopulmonary bypass surgery. *Br J Surg* 1991; **78**: 293–6.
7. Reath D, Maull K, Wolfgang T. General surgical complications following cardiac surgery. *Am Surgeon* 1983; **49**: 11–4.
8. Gonzalez OA, Orozco MA, Barrera ZL, et al. Abdominal complications resulting from cardiopulmonary derivation. *Rev Gastroenterol Mex* 1999; **64**: 61–9.
9. Aouifi A, Pirio V, Bastien O, et al. Severe digestive complications after heart surgery using extracorporeal circulation. *Can J Anaesth* 1999; **46**: 114–21.
10. Christenson J, Schmuziger M, Maurice J, et al. Gastrointestinal complications after coronary artery bypass grafting. *J Thorac Cardiovasc Surg* 1994; **108**: 899–906.
11. Kazunori Y, Masahiko M, Takaaki S, et al. Gastrointestinal complications in patients undergoing coronary artery bypass grafting. *Ann Thorac Cardiovasc Surg* 2005; **11**: 25–8.
12. Tsiotos G, Mullany C, Zietlow S, et al. Abdominal complications following cardiac surgery. *Am J Surg* 1994; **167**: 553–7.
13. Simic O, Strathausen S, Hess W, et al. Incidence and prognosis of abdominal complications after cardiopulmonary bypass. *Cardiovasc Surg* 1999; **7**: 419–24.
14. Sanisoglu I, Guden M, Bayramoglu Z, et al. Does off-pump CABG reduce gastrointestinal complications? *Ann Thorac Surg* 2004; **77**: 619–25.
15. Andersson B, Nilsson J, Brandt J, et al. Gastrointestinal complications after cardiac surgery. *Br J Surg* 2005; **92**: 326–33.