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RE-OPERATIONS FOR BLEEDING IN CARDIAC SURGERY: TREATMENT STRATEGY

Marek Gwozdziewicz*, Peter Olsak, Vladimir Lonsky

Department of Cardiac Surgery, University Hospital, Olomouc, Czech Republic
e-mail: gwozdziewicz@email.cz

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Aims: Cardiac surgery patients are prone to bleeding postoperatively owing to the extensive sternotomy wound, multiple vessel and heart sutures, and disorders of hemostasis. In this study we retrospectively analyzed the outcomes for all patients in our department who were re-operated for bleeding, over a 5 year period.

Methods: A total of 4297 patients underwent heart surgery between February 2002 and January 2007, of which 98 (2.3 %) were emergency reoperations for bleeding. We analyzed the process of indication for repeat surgery, possible source of bleeding, and postoperative complications.

Results: Most (85.7 %) of the reoperated patients had undergone their first operation as an elective cardiac procedure. The mean blood loss before the reoperation was 1557 ml. The studied group was characterized by increased mortality (11.2 %), longer ventilation period (35.1 hours) and ICU (4.5 days) and hospital (13.3 days) stays. The postoperative outcomes did not differ significantly between patients with TEG-detected coagulation disorder and the rest of the patients, or between patients treated with antilysin and those who did not receive antifibrinolytics.

Conclusions: It is vital for the indication process leading to reoperation of the bleeding patient to be as short as possible so as to minimize the delay to repeat surgery. Echocardiography including ultrasound of both pleural spaces, and TEG could shorten that time delay, and should always be included when evaluating patients. Platelets should be administered more often, with the use of antifibrinolytics reserved for cases with confirmed fibrinolysis.

INTRODUCTION

Cardiac surgery patients are prone to bleeding postoperatively from the operative field, owing to the extensive sternotomy wound, multiple vessel or heart suture lines, and disorders in hemostasis. If not promptly treated, postoperative bleeding can lead to death from cardiac tamponade or hemorrhagic shock. Meticulous drainage of the chest, accurate blood loss monitoring, and checking of the coagulation system are necessary during the postoperative period in these patients. Reoperation for bleeding is a life-saving procedure, with a reported incidence of 2–6 % (ref.[1-3]).

In this study we retrospectively analyzed the outcomes of all patients who were reoperated for bleeding, within 5 years in our department, to determine if our treatment strategy was satisfactory.

PATIENTS AND METHODS

A total of 4297 patients underwent heart surgery between February 2002 and January 2007, of which 98 (2.3 %) were emergency surgery for bleeding. Patients reopened for late tamponade diagnosed several days after the removal of chest drains were not included in this study. Women comprised 20.4 % (n = 20) of the studied group. The mean age of the entire cohort was 67.4 years. The preoperative characteristics of the patients are listed in Table 1. Redon drains (2-mm inner diameter) were used for postoperative blood collection in all patients except those who required the use of a cell-saver device immediately after the operation and received 32F chest tube drains[4]. The decision to re-explore a patient was made at the discretion of the individual surgeon. We analyzed the process of indication for repeat surgery, possible source of bleeding, and postoperative complications.

The recorded data were statistically analyzed using Statistica 6.0 software (StatSoft, Tulsa, OK), with the recorded variables compared using the Mann-Whitney test. A p value less than 0.05 was considered statistically significant.

RESULTS

Procedural outcomes and postoperative complications of reoperated patients are listed in Table 2. Fourteen (14.3 %) of the 98 patients had their primary operation performed on an emergency basis. There were 62 (63.3 %) operations for isolated coronary artery bypass surgery (CABG), 29 (29.6 %) for valve-related procedures, and 7 (7.1 %) for other reasons. Thirteen (21 %) of the 62 CABG operations were performed off-pump. Echocardiography was performed in 27 (27.5 %) patients before the reoperation, which diagnosed 10 (37 %) cases of cardiac tamponade. Thromboelastography (TEG) was performed in 56 (57.1 %) of the patients, which diagnosed coagulation dis-

order in 8 (14.2 %) patients, with the remaining patients exhibiting a normal coagulation curve. Antifibrinolytics were administered in 24 (24.5 %) of cases, fibrinolysis being confirmed by TEG in 1 patient.

The sources of bleeding found during reoperation are listed in Table 3, and were not identified in 45 (45.9 %) patients. The mean blood loss before the revision, the mean amount of blood collected in the chest during the reoperation, the mean amount drained after the revision, and the total blood loss are listed in Table 4. The mean numbers of erythrocytes (ERY) units and plasma (FFP) units administered per patient were 5.8 and 4.3, respectively. Platelets concentrate (PLT) was administered in 10 (10.2 %) patients. Cardiopulmonary resuscitation (CPCR) before or during the reoperation was required in 8 (8.2 %) patients. Eleven (11.2 %) patients died, of which 3 (27.3 %) received CPCR before or during the reoperation. More than one reoperation for bleeding was required in 7 (7.1 %) patients. Separate outcomes of these patients are listed in Table 5. This group of patients had a statistically greater pre-revision blood loss, more ERY and FFP units administered, and longer ventilation period and ICU stay. PLT administration and the length of the hospital stay did not differ significantly between repeatedly reoperated patients and the rest of the studied cohort. The postoperative outcomes for patients with TEG-detected coagulation disorder and the rest of the patients and for patients treated with antilysin and those who did not receive antifibrinolytics did not differ significantly.

CPCR patients had greater postrevision blood loss and FFP administration, and longer ventilation period and ICU stay. The pre-revision blood loss, amount of administered ERY units, and length of hospital stay for this group and the rest of the studied cohort were not significantly different.

Table 1. Preoperative characteristics of 98 patients.

	n (%)
Age (years)	67.4
Female	20 (20.4)
EF	49.2
Hypertension	75 (76.5)
Dyslipidemia	47 (47.9)
Diabetes mellitus (total)	31 (31.6)
Insulin dependant	8 (8.1)
Non-insulin dependant	23 (23.5)
Stroke	2 (2)
Obesity	17 (17.3)
Emergency surgery	15 (15.3)
CABG surgery (total) Off pump	62 (63.3) 13 (21)
Valve surgery	29 (29.6)
Other surgery	7 (7.1)

EF – ejection fraction
CABG – coronary artery bypass grafting

Table 2. Procedural outcomes and complications.

	n (%)
Repeat revisions for bleeding	7 (7.1)
Superficial or deep sternal infection	3 (3)
Atrial fibrilation	41 (41.8)
Confused states	7 (7.1)
Stroke	2 (2)
Pleural effusion requiring puncture	16 (16.3)
Myocardial infarction	0
Length of ventilation (mean-hours)	35.1
Length of ICU stay (mean-days)	4.5
Length of hospital stay (mean-days)	13.3
Number of erythrocytes transfusion (mean per patient)	5.8
Number of FFP transfusion (mean per patient)	4.3
Number of Platelets transfusion (mean per patient)	0.1
Use of antifibrinolytics	24 (24.5)
CPCR	8 (8.2)
mortality	11 (11.2)

ICU – intensive care unit
FFP – fresh frozen plasma
CPCR – cardio-pulmonary resuscitation

DISCUSSION

Postoperative bleeding requiring repeat surgery is a common practice in cardiac surgery units, with each department following its own schema regarding the treatment strategy of the bleeding patient, and each patient being treated more or less on an individual basis. The presented study analyzed the outcomes for 98 patients who received emergency reoperations for bleeding within a 5 year period, in our department. Most (85.7 %) of the reoperated patients had undergone their first operation as an elective cardiac procedure.

As expected, the studied group was characterized by high mortality (11.2 %), long ventilation period (35.1 hours) and ICU (4.5 days) and hospital (13.3 days) stays, and high administration of blood products. Interestingly, the administration of ERY, FFP, and PLT in patients with a coagulation disorder, aprotinin administration, and CPCR caused no significantly differences, with the only exception being those who had repeat revision for bleeding.

There was surprisingly large amount of blood loss (Table 4) before the reoperation (mean, 1557 ml), and it was significantly greater in patients undergoing repeat revision and in those with coagulation disorder. The mean time between ICU admission and reoperation (9 hours) and the blood loss both seemed excessive. It is important to understand that all patients reopened for bleeding exhibit some blood collection in the chest (in addition to the drainage blood loss), which increases the total blood

Table 3. Sources of bleeding found during reoperation.

Source of bleeding	n (%)
Peripheral bypass anastomosis	14 (14.2)
Branch of internal thoracic artery	13 (13.3)
Sternum or mediastinal soft tissue	18 (18.4)
Heart or aorta suture line	8 (8.2)
Not found	45 (45.9)

Table 4. The blood losses.

	ml (mean)
Before the reoperation	1557
Blood collection in the chest during reoperation	702
After the reoperation until drains removal	1240
Total blood loss	3499

Table 5. Separate profile and outcomes of 7 patients who required more than one revision for bleeding.

	n (%)
age	68.5
female	2 (28.6)
EF	45
Diabetes mellitus	1 (14.2)
Obesity	0
Emergency surgery	2 (28.6)
CABG surgery	4 (57.1)
Valve surgery	3 (42.8)
Other surgery	0
Sternal infection	1 (14.2)
Confused states	1 (14.2)
Stroke	0
Pleural effusion requiring puncture	2 (28.6)
Blood loss (mean)	
Before the reoperation	3123
In the chest during reoperation	1193
After the reoperation until drains removal	1968
Total	6284
Length of ventilation (mean-hours)	35.1
Length of ICU stay (mean-days)	12.1
Length of hospital stay (mean-days)	18.5
CPCR	0
Mortality	3 (42.8)

loss until the time of repeat surgery. In our cohort the mean amount of blood found in the chest during repeat surgery was 702 ml.

It seems reasonable to perform echocardiography (together with ultrasonography of the pleural spaces) in every bleeding patient. This could inform about the danger of evolving heart tamponade and help to estimate blood collection in the pericardial and pleural spaces. Unfortunately, echocardiography was only performed in 27.5 % of our patients before the revision, which detected tamponade in 37 % of cases. The substantial time delay before reoperation could be also responsible for the relatively high percentage of cases (45.9 %) in which no source of bleeding was found during surgery. Bleeding is especially likely to stop in time in branches of the internal thoracic artery (a common source of bleeding), due to vasospasm or coagulum compression. TEG has been shown to be an indispensable tool for distinguishing between surgical and nonsurgical bleeding[5]. This examination was applied in 57.1 % of our cases, but diagnosed coagulation disorder in only 14.2 % of the examined patients. Its wider application could probably lead to earlier revisions. Only one patient with confirmed coagulopathy was reoperated for bleeding more than once, and only one patient in this group died.

There was also a surprisingly low rate of PLT application (10.2 %) in our reoperated patients. Taking into account that platelets dysfunction is a major contributor to postoperative coagulopathy, their use should probably be considered more often. A relatively large proportion (8.2 %) of patients were resuscitated before or during the reoperation, three (37.5 %) of whom died during the follow-up period.

Some surgeons are concerned about repeat sternotomy leading to subsequent sternum infection, which leads to them postponing the revision. Sternotomy infection was present in only three (3 %) of our patients, which indicates that the risk of such infection is relatively small (this has also been found in similar previous studies)[3].

In conclusion, most patients reoperated for bleeding had undergone elective primary operations and do not have TEG-detected coagulopathy. It is crucial for the indication process leading to reoperation of the bleeding patient to be as short as possible so as to minimize the delay to repeat surgery. Echocardiography including ultrasound of both pleural spaces, and TEG could shorten that time delay, and should always be included when evaluating patients. Platelets should be administered more often, with the use of antifibrinolytics reserved for cases with confirmed fibrinolysis.

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