

Temporary Closure for Sternotomy in Patient with Massive Transfusion Might Be Lethal

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A 58-year-old male visited our emergency room for multiple traumas from explosion. On initial evaluation, hemopneumoperitoneum with liver laceration (grade 4) and colon perforation was identified. Hemopericardium with cardiac tamponade was also identified. Shrapnel was detected in the right ventricle. Damage control surgery was planned due to condition of hypotension. In operation room, control over bleeding was achieved after sternotomy, pericardiectomy, and laparotomy. Massive transfusion was done during operation. After gauze packing, operation was terminated with temporary closure (TC). Sanguineous fluid was drained profusely. Disseminated intravascular coagulopathy was confirmed through laboratory findings. No extravasation was discovered at hepatic angiogram. On re-operation, there was no active bleeding but oozing from sternotomy site was identified. Bone bleeding was impossible to control. Finally, re-operation was ended after gauze packing and TC all over again. The patient could survive for only a day after re-operation. [J Trauma Inj 2017; 30: 12-15]

Key Words: Hemorrhage, Disseminated intravascular coagulation, Mortality, Multiple trauma, Sternotomy

Damage control surgery (DCS) with temporary abdominal closure is one of the common operation options in severe abdominal trauma patients.(1-3) Trauma patients easily develop abdominal compartment syndrome, and usually require early re-exploration. Moreover, they need time to correct lethal triad of coagulopathy, acidosis, and hypothermia. In addition, in thoracic and orthopedic trauma patients, damage control surgery showed better outcomes.(4,5) Therefore, at the time of initial operation, the patients with severe trauma are usually treated not by definite surgery, but by DCS and temporary closure (TC).

This article reports a patient with lethal bleeding at sternotomy site after damage control surgery

with temporary closure.

I. Case Report

A 58-year-old male visited our emergency room for multiple traumas from bomb explosion. He showed multiple penetrating wounds all over the body; however, his mental status and vital signs were stable. On initial CT, hemopneumoperitoneum with liver laceration (grade 4) and colon perforation were identified (Fig. 1). Shrapnel at right ventricle (RV) and hemopericardium were also identified. Patient showed hypotension and tachycardia despite of initial resuscitation. Therefore, damage control surgery was planned.

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In operation room, long midline incision from sternum notch to symphysis pubis was made. Bleeding was controlled after median sternotomy, pericardiotomy, and laparotomy. Shrapnel in RV wall did not lead to any hemodynamic instability so it was decided to remove shrapnel at the time of re-exploration after temporary closure. In addition, injured liver was sutured and perforated colon was stapled. Gauzes and other hemostatic agents were packed. After temporary closure, initial damage control surgery was closed (Fig. 2).

Results of laboratory examination are shown at Table 1. On examination in the emergency room, decrease in fibrin degradation product (FDP), increase in D-

dimer and fibrinogen, and decrease in antithrombin activity was observed. During initial operation, 31 packs of packed red blood cell (PRC), 18 packs of fresh frozen plasma (FFP), and 10 packs of platelet concentrate (PC) were transfused. However, enhancement in prothrombin time (PT) and activated partial thrombin time (aPTT) was observed as compared with initial examination, and decreased level of fibrinogen and platelet was observed on post-operative examination.

Profuse drainage of sanguineous fluid was carried out through wall suction. Disseminated intravascular coagulation (DIC) was confirmed through laboratory findings. Although antithrombin had some argument, however, it was applied after identifying DIC.(6) To identify and control hepatic bleeding, angiogram was performed; however, there was no extravasation on liver. Resultantly, re-exploration was decided. Similar to preoperative radiologic eval-



Fig. 1. Initial CT showed active bleeding from injured liver and shrapnel in heart.



Fig. 2. Temporary abdominal and thoracic closure after damage control surgery.

Table 1. Result of laboratory examination

Laboratory marker	Normal range	Initial	Post-operation
Fibrinogen	200-400	62.1	53.9
Antithrombin II	75-120	48.7	
D-dimer	0-0.71	36.9	
Fibrin degradation product	0-5	101.1	
Prothrombin time	9.9-13.5	11.5	23
Activated partial thrombin time	21.0-38.0	28.8	2분
Platelet	150-450	217000	61
Hemoglobin	13.0-18.0	11.8	13.9
Hematocrit	40.0-54.0	33.8	40.3

Normal range was made by department of laboratory medicine in author's institution.

uation, there was no active bleeding. However, operation team observed continuous oozing of dark blood from sternotomy site. Various hemostatic methods were applied. Bone wax and hemostatic glue were applied after electrocauterization. Cut surface was sutured compressively with tube and wire. However, it was impossible to control bone bleeding. Finally, operation was terminated after gauze packing and TC all over again. The patient could survive for only a day after re-operation. The institutional review board approved this report and informed consent was waived.

II. Discussion

Sternum has cancellous bony structure for hematopoiesis and flexibility owing to inspiration and expiration of chest. Therefore, it is prone to massive hemorrhage after surgical cutting, reaming, drilling, and curettage.(7,8) There exist several studies about sternotomy.(9,10) Common morbidity after sternotomy has been reported as dehiscence, mediastinitis, and infections.(8) However, there is no report about lethal bleeding at sternotomy site. Accordingly, the present article reports first lethal case after sternotomy.

Bleeding in the patient was managed by thermal, mechanical, and chemical methods.(11) By electrocautery, operator might intend sealing and attempt to achieve shrinkage of vessel. Moreover, operator uses direct vessel ligation or suture closure to control bleeding. In addition, bone wax is well known sealing material for bone. However, there several reports demonstrate bone wax related complications, which raise concerns about its benefit. Increased sternal dehiscence has been reported to be associated with bone wax.(12) Also it showed no statistical difference in blood product consumption, early rethoracotomy, sternum stabilization, and mediastinitis.(13) Additionally, there exist other chemical products, which promote blood coagulation like oxidized cellulose, gel sponges, and collagen fleece.(11) Nevertheless, further studies are necessitated to generate definite results.

The patient was after severe multiple trauma. After DCS, it was time to correct lethal triad like coag-

ulopathy. During first operation, it was conjectured that bleeding was under control. However, ongoing bleeding was identified at the drain followed by massive transfusion. These conditions are common etiologies of DIC. Therefore, coagulopathy was aggravated and bleeding continued. In this situation, TC after sternotomy in patients with massive transfusion might be lethal, because bone bleeding from sternotomy wound might be hard to control owing to DIC.

Yellin et al reported a case with complicated major bleeding after cardiac surgery.(14) They concluded that meticulous technique might decrease bleeding. Especially, the presented patient had injured not only heart, but also liver and colon. Therefore, trauma surgeons tried to carefully control bleeding. However, more meticulous approaches for controlling bleeding might be helpful.

In conclusion, multiple trauma patients after sternotomy might be trapped into vicious cycle of DIC. Authors reported lethal TC after sternotomy in a patient with massive transfusion. There exists necessity of extra meticulous approaches for controlling bleeding in patients with multiple major traumas.

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