Foley catheter and deep hypothermic circulatory arrest to control bleeding in redo cardiac surgery

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Two cases with catastrophic hemorrhage in redo cardiac surgery are described. In the first one tearing of right ventricle with uncontrolled bleeding occurred during sternal reentry. In the second one, tearing of the right atria occurred while the patient was on cardiopulmonary bypass. In both cases we were able to control bleeding using Foley catheter, which enabled us to proceed to deep hypothermic circulatory arrest to repair heart chambers (due to dense adhesions it was impossible to manage it in any other way). We have found this combined technique to be extremely useful tool to control catastrophic hemorrhage during redo cardiac surgery.

Keywords: reoperation, bleeding, Foley catheter, circulatory arrest

INTRODUCTION

Repeat cardiac surgery represents eight to twenty five percent of cardiac surgical procedures.1-2 A number of techniques have been described to reduce the incidence of injury to the heart and mediastinal structures. During sternal reentry, catastrophic hemorrhage remains a dreaded complication. In such a situation it is essential to control the bleeding while instituting cardiopulmonary bypass (CPB) to maintain partial perfusion. The use of Foley catheter in cardiac surgery to control the bleeding during repair of cardiac chambers has been described in several reports.3-4 Deep hypothermic circulatory arrest (DHCA) to control the tear of the heart5, or to facilitate deliberation of severe adhesions and reduce the risk of tearing and injury of the heart and great vessels during preparation has also been reported in redo cardiac surgery.6 To the best of our knowledge, combination of these two techniques to solve the bleeding problem in redo cardiac surgery has not yet been reported.

CASE REPORTS

Patient 1

A 61-year-old man presented at our institution with progressively increasing dyspnea on exertion. Six years earlier this patient undergone aortic (disc prosthesis, 21 mm) and mitral valve (bileaflet prosthesis, 27 mm) replacement. Severe periprosthetic leakage (due to partial dehiscence of both prosthesis), associated with high gradient across the aortic prosthesis were revealed using transesophageal echocardiography (TEE). Ejection fraction was calculated to be 0.40 and there were no significant atherosclerotic lesions on coronary arteries. The patient was scheduled for redo cardiac procedure (double prosthesis replacement and tricuspid valve annuloplasty due to severe tricuspid regurgitation).

A mid-sternotomy was performed with standard reciprocating saw (as we have been doing for last 15 years in redo cardiac procedures). Though massive hemorrhage (ruptured right ventricle) had occurred during re-entry, Foley catheter was used to temporary control the bleeding (it was inflated inside the right ventricle and then gently pulled to seal the tear). At the same time CPB was instituted via femoral vessels. The right ventricle had been incorporated in dense sternal scar and it was impossible to repair lacerated right chamber (due to dense adhesions any further adhesiolysis led to new injuries, and we placed another Foley catheter to control new bleeding site). Finally, we were forced to proceed to DHCA to control the tear and to facilitate deliberation of severe adhesions. It has to be underlined that control of bleeding with Foley catheters enabled us to proceed to DHCA. During the safe period of DHCA (55 minutes at 18°C), we were able to deliberate the heart completely, to repair the tear of the right ventricle (lacerations were closed with pledged mattress sutures), and even to perform the part of planned procedure (tricuspid valve annuloplasty). Then, the CPB
had been restarted and we completed surgical procedure
(with aorta cross-clamped, using cold blood cardioplegia, aortic and mitral prostheses were replaced, using bileaflet prostheses, 21 mm and 27 mm, respectively). Routine de-
airing and rewarming was done.

The patient was weaned from CPB without difficulty. He
awoke on first postoperative day without any neuro-
logical sequela, and respiratory support was discontinued
after 48 hours. Two weeks after surgery (postoperative
TEE showed normal functioning of mitral and aortic pro-
theses, trivial tricuspid valve regurgitation together with
preserved ventricular function) he is about to be dis-
charged to home.

**Patient 2**

A 63-year-old woman was admitted due to recurrent an-
gina (8 years following primary coronary artery bypass
grafting procedure) not relieved by optimal medical ther-
apy. Cardiac catheterisation and angiography revealed
bad left ventricular function (ejection fraction of
0.30) with severe triple-vessel disease. Right coronary ar-
tery (RCA) and circumflex artery (RX) as well as all gra-
fts (LIMA to LAD, venous grafts on RCA and marginal
branch of RX) were occluded. There were two consecu-
tive stenoses of 90% on LAD and PTCA for these lesions
was recommended. Unfortunately PTCA of LAD lesions
had failed and she was presented for emergency surgery
due to hemodynamic instability.

A mid-sternotomy was performed with standard recip-
rocating saw. The left ventricle had been incorporated in
dense sternal scar so we concentrated on freeing only the
right side of the heart and small area of aorta for cannula-
tion. Following heparinisation CPB was instituted (ascen-
ding aorta was the site of arterial cannulation and venous
cannulation was accomplished with a single two-stage ri-
ght atrial cannula). Further deliberation of the heart was
very difficult due to extremely dense adhesions. During
gentle manipulation with venous line, at once we have
produced huge tearing of the right atrium (3 x 2 cm), and
it was impossible to aspirate all the blood through suction
lines. CPB was stopped for a while, but it was impossible
to repair the right atrium which continued to tear. Foley
catheter was inflated inside the right atrium and gently po-
uled to seal the rupture, while we restarted the CPB. Foley
catheter enabled us to DHCA. During the safe period of DHCA (42 minutes at 18°C), we were able to deliber-
ate the heart completely, to repair the tear of the right
atrium (we had to use pericardial patch), and to per-
form the single bypass (venous graft on LAD, proximal
anastomosis was constructed on the hood of old vein graft
for RCA). Then, the CPB have been restarted and routine
de-airing and rewarming was done.

The patient was weaned of cardiopulmonary bypass eas-
ily. The patient's postoperative course and convalescence
progressed without any difficulty, and she was discharged
with no angina, ten days later.

**DISCUSSION**

Repeat median sternotomy is a common part (8-25 %)
of cardiac surgical practice.1,2 Associated with sternal
reentry are the risks of cardiac injury and catastrophic
hemorrhage and the subsequent elevated morbidity and
mortality in the operating room or during postoperative
period. Thus, closing the pericardium at the first operation
or interposing mediastinal tissue or pericardial substitute
is strongly recommended as preventive measures against
reoperative cardiac injury.3,5 Probably, the most secure way
how to perform repeat median sternotomy is endoscopic
or video assisted resternotomy,1,6 because it provides ex-
cellent visualization of all retrosternal structures and ad-
hesions allowing safe and meticulous dissection prior to
sternal reentry.

Unfortunately, massive hemorrhage does occur from
time to time during resternotomy. Though any traction
and manipulation inside the thorax to control the hemor-
rhage will extend and deepen the laceration (leading to in-
creased blood loss or eventually to exsanguination) in
such a case temporary hemostasis should be obtained. Ex-
peditious institution of CPB via cannulation of femoral
vessels is mandatory. Then we can gain exposure by dis-
section of adhesions and sternal mobilization before the
division is completed and the retractor inserted under car-
diac decompression. The bleeding sites are identified and
with adequate visualization, defects are closed with
pledgetted sutures. Sometimes, it is even necessary to pro-
cceed to DHCA to control the tear or to facilitate delibera-
tion of severe adhesions and reduce the risk of tearing
and injury of the heart and great vessels during preparation.2,5

There have been several reports regarding the use of
Foley catheter in cardiac surgery,3,4,6 some of them being
attributed to redo cardiac surgery.3,7 In these reports, the
Foley catheter was inserted through the defect or lacer-
arion and its balloon inflated inside of cardiac chamber and
then gentle traction applied to control the bleeding.3,4 The
use of Foley catheter (with malleable guidewire) for tem-
porary external compression of an aortic bleeding site has
also been reported.7,8

In both of our cases balloon of Foley catheter was in-
fated (in right ventricle and right atria, respectively) and
used to temporary control the bleeding. As it was impossi-
ble to repair the injured heart structures (due to dense ad-
hesions any further adhesolysis lead to new injuries) we
were forced to proceed to DHCA to control the tear and to
facilitate deliberation of severe adhesions. DHCA has
been well known technique for solving similar difficult
problems in redo cardiac surgery.2,5,8 It has to be under-
lined that control of bleeding with Foley catheter enabled
us to proceed to DHCA. During the safe period of DHCA
(55 and 42 minutes at 18°C, respectively), we were able
to repair the tear of heart chambers in both patients, to de-
liberate the heart completely, and even to perform the part
of planned procedure (tricuspid valve plasty and bypass
surgery, respectively). We strongly believe that these
combine technique might be lifesaving procedure in same
cases of catastrophic hemorrhage during redo cardiac sur-
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gery and therefore have to be drawn in the baggage of
knowledge of an experienced cardiac surgeon.

SUMMARY

Prikazana su dva slučaja po život opasnog krvarenja kod
reoperacija u kardiohirurgiji. Kod jednog bolesnika krva-
renje je uzrokovano laceracijom desnog komore prilikom
resternotomije. Kod drugog pacijenta pocepal se desna
pretkomora kada je kod bolesnika već bio uspostavljen
vantelesni krvotok. U oba slučaja kontrola krva
renja je postignuta upotrebom Foley katetera (kateter je nađu
van u odgovarajućoj srčanoj šupljini, a zatim je nežnom trakci-
jom doveden u poziciju da začepi mesto rupture). Pošto
je zbog izuzetno čvrstih adhezija bilo nemoguće oslobo-
diti srce i uraditi hiruršku hemostazu, oba bolesnika su
uvedena u duboki hipotermijski cirkulatorni arest. Tada je
dovršeno oslobađanje srca od pritaslica i saniranu su rupt-
turu srčanih šupljina. Smatramo da je kombinacija naved-
enih tehnika izuzetno koristan pristup u rešavanju pro-
blena po život opasnog krvarenja kod reoperacija u kard-
iohirurgiji.

Kljucne reči: reoperacija, krvarenje, Foley kateter,
cirkulatorni arest

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