Commentary: Squeezing cardiac surgery into the damage control rubric

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Misfeld and colleagues\(^1\) stimulate our thinking and expand our horizons by drawing parallels with proven strategies for damage control in general and trauma surgery. We are grateful for this novel perspective.

However, it is a difficult fit to conform cardiac surgery to the general surgery damage control rubric. There are important fundamental differences between the abdomen and the heart in terms of damage control possibilities. In the abdomen, an important part of damage control is to terminate soilage of the peritoneal cavity by diverting contents of damaged intestines. This has no direct parallel in the pericardial space. In the abdomen, certain organs are dispensable: the spleen can be removed, feet of intestines can be resected, and a kidney can be removed if necessary. There are no such parallels with the heart. And, temporary dysfunction of intra-abdominal organs (ie, kidneys, liver, and intestines) can be tolerated to stem bleeding and preserve life. Not so for the heart, whose function (barring mechanical replacement) is necessary to continue from second to second. So, the anatomic and physiologic substrate for application of damage control is very different between the pericardial and abdominal body cavities.

Despite these fundamental differences, the authors are able, in a complex, multilevel rubric, to meaningfully accommodate cardiac surgery into the damage control mindset. They present this clearly in their text and tables.

CENTRAL MESSAGE

Misfeld and colleagues expand our horizons by viewing cardiac surgery through the lens of damage control borrowed from trauma surgery.

Does fitting cardiac surgery into the damage control rubric provide novel insights and therapeutic pathways? The authors touch on important matters of judgment and technique, but it is not clear that these insights are achieved or augmented by the damage control perspective.

It is worth focusing on some of the specific technical matters raised in the report by Misfeld and colleagues,\(^1\) many of which we address in our upcoming textbook *Practical Tips in Aortic Surgery*.\(^2\) We agree fully with the perspective of Misfeld and colleagues\(^1\)—specifically, that being prepared with a well-thought-out plan for serious intraoperative surgical challenges is essential to optimize patient salvage from desperate situations. Here we discuss several of these scenarios and offer specific concrete management options.

**MASSIVE HEMORRHAGE UPON RE-ENTRY INTO A PREVIOUSLY OPERATED CHEST**

One generally has 2 choices when a cardiac chamber (usually right ventricle, right atrium, or aorta) is breached during redo sternotomy resulting in hemorrhage. One choice is to institute cardiopulmonary bypass, urgently dissect the heart, and continue with surgery. The other choice, quite simple, is to reapproximate the divided section of the sternum with towel clips, which almost always controls the bleeding (because, due to adhesions, there is no space for continued bleeding) (Figure 1). Then, the outer table of the opened portion of the sternum is reapproximated with wires, replacing the towel clips, and routine closure of
the soft tissues is carried out. Then, weeks later, surgeons can come back, often with a different anatomic approach, for an elective controlled second chance at surgery.

UNCONTROLLED AORTIC BLEEDING
In aortic surgery, a prime focus is prevention of uncontrolled bleeding. We have found a simple technique to be extraordinarily effective in preventing bleeding problems in ascending, arch, and descending aortic surgery. One can easily see and control the anterior two-thirds of an aortic anastomosis. The problem is the posterior one-third of the anastomosis. This is difficult to visualize and to access for further control measures. Often, the mere act of retraction of the aorta for inspection exacerbates the bleeding problem itself substantially. For this reason, we routinely place a short row of interrupted mattress sutures in the posterior wall of the aortic anastomosis before completing the anterior wall (Figure 2). We call this the best 2 minutes one can spend in the operating room. This simple maneuver prevents the vast majority of bleeding problems in thoracic aortic surgery. As the saying goes, an ounce of prevention is worth a pound of cure.

GENERAL SEVERE BLEEDING AFTER CARDIOPULMONARY BYPASS
We have not favored open packing and prolonged observation in the intensive care unit for patients with severe generalized bleeding after open heart surgery. We worry about the continued exposure of graft material to the environment. Rather, we close the chest, with large-bore drains in place, and observe the patient closely right on the operating table in the operating room. We find that approximation of the chest wall tissues usually allows bleeding to settle down over an hour or 2. If bleeding continues to be severe, we reopen and explore. By this time, most generalized ooze will have subsided, and the surgeon will have a better chance at isolating and controlling major bleeding sites. Of course, concomitantly, during the 1 or 2 hours of chest closure and observation, all medical efforts to promote the hemostatic state are pursued.

INABILITY TO CLOSE THE CHEST
We agree with Misfeld and colleagues that chest closure may produce severe hemodynamic consequences for a struggling heart. However, rather than leave the chest open, we take an alternate posture: We close the soft tissues, leaving the bone open. This is almost always feasible, without any undue pressure on the underlying heart. We secure a large piece of bovine pericardium under the breastbone to prevent tearing of the heart chambers against the inner bony table. Then, we approximate the fatty tissues and skin fully overtop of the open breastbone. It is always possible to bring these tissues together. This restores proper
isolation of the heart and grafts from the environment. When the patient recovers, this can be converted to a standard closure. Or, in patients who continue to be sensitive, this can be left as a final closure, without undue consequences.²

We congratulate Misfeld and colleagues¹ for imaginatively encouraging cardiac surgeons to think outside the box in implementing the damage control point of view for the small proportion of patients undergoing cardiac surgery for whom such a salvage approach is necessary.

References
1. Misfeld M, Bannon PG, Borger MA, Yan TD. Damage control in cardiac surgery: knowing when to come back another day. J Thorac Cardiovasc Surg. 2021;10:362-6.
2. Elefteriades JA, Ziganshin BA. Practical Tips in Aortic Surgery. Springer; 2021. ISBN 978-3-030-78877-3.