

# First Cardiopulmonary Bypass Anticoagulation Guidelines Issued

Patrice Wendling

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CHICAGO — The Society of Thoracic Surgeons (STS), the Society of Cardiovascular Anesthesiologists (SCA), and the American Society of ExtraCorporeal Technology (AmSECT) have published the first clinical practice guidelines for anticoagulation therapy during cardiopulmonary bypass (CPB).<sup>[1]</sup>

Guideline writing committee chair Dr Linda Shore-Lesserson (Northshore University Hospital, Manhasset, NY) explained in an email to *theheart.org* | *Medscape Cardiology* that "Heparin management techniques have been mentioned in the STS/SCA blood conservation guideline but only in the context of reducing blood utilization. These guidelines refer to the safety of anticoagulation practices in heart surgery."

She continued, "No prior guidelines have been published on this topic and the education gap is there."

The American College of Cardiology and American Heart Association have not issued CPB anticoagulation guidelines, and published surveys show enormous variability in the use and dosing of heparin, monitoring of heparin, reversal of anticoagulation, and use of alternative anticoagulants, such as bivalirudin (*Angiomax*, The Medicines Company).

"The ideal anticoagulation strategy for cardiac surgery with CPB in patients who cannot take heparin does not exist. Heparin and protamine remain the gold standard for anticoagulation therapy," according to the document, copublished online January 19, 2018, in *The Annals of Thoracic Surgery, Anesthesia & Analgesia* and the *Journal of ExtraCorporeal Technology*.

The report is based on a review of 96 papers published from 2000 to December 2015 and 17 sentinel papers published before 2000. It contains several recommendations, but only two are class 1 recommendations:

- A functional whole blood test of anticoagulation, in the form of a clotting time, should be measured and demonstrate adequate anticoagulation before initiation of and at regular intervals during CPB.
- Discontinuation of protamine and implementation of resuscitative measures, including reinstitution of CPB with adequate anticoagulation, may be lifesaving for patients at high risk for anaphylactic response to protamine who have pulmonary hypertension and circulatory collapse.

Other key messages for clinicians, Shore-Lesserson said, are the following:

- Heparin dosing calculations may differ so long as the result achieves the desired target level of anticoagulation.
- It's reasonable to maintain an activated clotting time (ACT) above 480 seconds during CPB. However, ACT is a "gross and imperfect," test and the testing platform affects the target value of ACT.
- Heparin reversal should be carefully calculated with low doses of protamine, so long as heparin rebound is controlled for.

If protamine can't be used for reversal of heparin anticoagulation, "there are not enough data to make a recommendation regarding safety and efficacy of any of the alternative heparin reversal agents," the authors write.

Studies have shown that recombinant PF4 provides adequate heparin neutralization; however, preformed antibodies against the PF4–heparin complex are important contributors to heparin-induced thrombocytopenia (HIT). Methylene blue, hexadimethrine, vancomycin, and heparinase I also have been tested, but "none of these drugs has proved equivalent to protamine in its safety profile for reversal of heparin after CPB," they note.

Regarding alternatives to heparin itself, the guidelines include a class IIa recommendation (level B evidence) that "bivalirudin is a reasonable option" for patients in need of urgent surgery requiring CPB with a diagnosis of HIT.

In patients with significant renal dysfunction who are seropositive for HIT and require urgent CPB-assisted surgery, a class IIb recommendation (level C evidence) suggests that use of plasmapheresis, argatroban, or

heparin with antiplatelet agents, such as tirofiban and iloprost, "may be considered, understanding that there are increased risks of bleeding with these interventions."

For patients given bivalirudin who have excessive bleeding after CPB, "a combination of modified ultrafiltration, hemodialysis, and the administration of recombinant factor VIIa with blood product replacement may be considered to improve hemostasis in these extreme circumstances," according to a class IIb recommendation (level C evidence).

"More research is needed into alternative anticoagulants for CPB and heparin resistance," Shore-Lesserson said.

*Shore-Lesserson has disclosed no relevant financial relationships. Disclosures for her coauthors are listed in the paper.*

*Follow Patrice Wendling on Twitter: [@pwendl](#). For more from [theheart.org](#) | Medscape Cardiology, follow us on [Twitter](#) and [Facebook](#).*

## References

1. Shore-Lesserson L, Baker RA, Ferraris VA, et al. The Society of Thoracic Surgeons, the Society of Cardiovascular Anesthesiologists, and the American Society of ExtraCorporeal Technology: clinical practice guidelines – anticoagulation during cardiopulmonary bypass. *Ann Thorac Surg* 2018;105:650-62. [Article](#)

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