injection. An attractive alternative to UFH during pregnancy is LMWH, which can be given subcutaneously once or twice daily and does not require monitoring. Suprarenal IVC filters have also been used successfully during pregnancy without significant morbidity. In women with APS who become pregnant, therapy is critical to prevent fetal loss; aspirin (160 mg) is combined with prophylactic doses of either subcutaneous UFH (10,000 to 15,000 U/day in divided doses) or LMWH (to achieve an anti-Xa level of 0.1 to 0.3 U/mL). When such women have a history of thromboembolic disease, therapeutic doses of LMWH or UFH plus aspirin are employed.

Heparin should be discontinued at the time of labor and delivery, although the risk for hemorrhage is not high during delivery, especially if anti-Xa levels are less than 0.7 U/mL. One concern with residual anticoagulation at delivery is the risk for spinal hematoma with epidural anesthesia; this concern has been reported with both UFH and LMWH. The anti-Xa level that is safe for an epidural procedure is not known. Protamine sulfate can be used to neutralize UFH if the PTT is prolonged during labor and delivery; however, LMWH is only partially (10%) reversed by protamine.

Anticoagulation during the postpartum period can be carried out with heparin or warfarin; neither drug is contraindicated during breast-feeding. Women receiving long-term warfarin therapy (e.g., for valvular heart disease) who wish to become pregnant need to be switched to a fully anticoagulating dose of UFH or LMWH; warfarin treatment may be restarted after delivery.

Perioperative Anticoagulation

A common clinical problem is the management of anticoagulation in patients who require surgery. The principles of care in this situation reflect the need for adequate hemostasis during and immediately after surgical procedures as well as the critical importance of restarting anticoagulation as soon as possible postoperatively, especially because surgery itself represents a relative hypercoagulable state. The perceived risk for thromboembolism in patients with atrial fibrillation clearly affects the management of perioperative anticoagulation; in this clinical situation, the CHADS-2 score (*c*ardiac failure, *h*ypertension, *a*ge, *d*iabetes, and *s*troke) may estimate postoperative stroke risk and thus dictate the need for bridging anticoagulation with UFH/LMWH when stopping vitamin K antagonist. For patients with VTE who are anticoagulated on a short-term basis (<1 month), elective surgical procedures should be postponed; if such patients must undergo surgery, discontinuation of anticoagulation and placement of a temporary IVC filter may be the best option. In most patients receiving long-term anticoagulation for VTE, preoperative heparin is not typically used; vitamin K antagonist should be discontinued for at least 4 days preoperatively to allow the INR to decrease gradually to less than 1.5, a level that is safe for surgery. Postoperatively, intravenous heparin (or SC LMWH) can be safely used for anticoagulation until therapeutic INR levels are reached after warfarin has been restarted. As with all guidelines, individual patient circumstances may dictate changes. For example, institution of heparin immediately after a major surgical procedure may be contraindicated because of the high risk for hemorrhage; reinstitution of anticoagulation may need to be delayed for 12 to 24 hours postoperatively.

For a deeper discussion on this topic, please see Chapter 171, "Approach to the Patient with Bleeding and Thrombosis," in Goldman-Cecil Medicine, *25th Edition.*

SUGGESTED READINGS

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