Postoperative Anticoagulation After Neurologic Surgery

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KEYWORDS

• Anticoagulation • Antiplatelet • Atrial fibrillation • Mechanical heart valve • VTE • Stent-coil • Pipeline • Intrathecal access

KEY POINTS

- Reinitiation of antiplatelet and anticoagulant medications after neurosurgery is complex, but the process can be aided by scoring systems to stratify the risk/benefit ratio.
- Most neurosurgical patients are at high risk of postoperative venous thromboembolism.
- Appropriate prophylaxis with pneumatic compression devices, graduated compression stockings and pharmacologic prophylaxis can significantly decrease complication rates.
- Management of antiplatelet medications before and after placement of neuroendovascular devices can be aided with the use of readily available platelet function assays. Patients can experience significant resistance or responsiveness to these medications.
- Placement of intrathecal access devices (ventricular drain, lumbar puncture or lumbar drain catheter) in the setting of antiplatelet or anticoagulant medications can be dangerous, but can be done safely using proper precautions.

INTRODUCTION

Neurosurgeons are performing more procedures on a wide variety of patients, many of whom are advanced in age and have multiple medical comorbidities. These multifactorial medical issues may necessitate the use of anticoagulant or antiplatelet medications, of which use has increased in the United States in recent years.[1,2] In addition, there are neurosurgical conditions and devices that necessitate the use of these medications as part of the treatment algorithm.[3]

The debate as when to reinstitute postoperatively or, in some cases, begin treatment with preoperatively these medications has been a long-standing debate in the field. A balance must exist between preventing venous thromboembolism (VTE), pulmonary embolism (PE) and ischemic stroke, with preventing postoperative hematoma in the surgical bed. This review seeks to elucidate how to best reinitiate anticoagulation therapy for patients after neurosurgical procedures and intracranial hemorrhage (ICH), demonstrates appropriate management of antiplatelet therapy after placement of neuroendovascular devices, reviews postoperative initiation of VTE prophylaxis and treatment modalities, and reviews the safety of cerebrospinal fluid access procedures (ventricular drain, lumbar puncture, lumbar drain) on patients taking anticoagulation or antiplatelet therapy.

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PATIENTS WITH STRUCTURAL DISEASE WHO NEED ANTICOAGULATION

Atrial Fibrillation

Atrial fibrillation (AF) is the most common cardiac arrhythmia in the elderly and millions of people in the United States have been diagnosed with AF, with incidence expected to increase in the coming years.[4] One of the principal complications of AF is ischemic stroke. Assessment of risk of stroke in nonvalvular AF has been validated with multiple scoring systems, including $CHADS_2$ and its more updated counterpart, CHA_2DS_2VASc. These scoring systems account for congestive heart failure, hypertension, age greater than 75 years, diabetes mellitus, history of prior stroke or transient ischemic attack, and additionally in CHA_2DS_2-VASc: history of vascular disease, age between 64 to 75 years, and sex (female gender). This scoring system gives 1 point for presence of each risk factor (2 points for history of previous stroke/transient ischemic attack or age >75 years) and the total score corresponds with a percent annual stroke risk, with higher scores having higher annual risk of stroke. Patients with a score of 2 or greater have been shown to be at high risk of stroke (2.2% risk for a score of 2, with risk increasing for each additional point) and are recommended to take oral anticoagulation using either a vitamin K antagonist, such as warfarin, or a novel oral anticoagulant (NOAC) on the basis of guidelines from the American College of Cardiology/American Heart Association and the European Society of Cardiology.[5,6] In early trials, warfarin was shown to prevent stroke in AF compared with placebo/aspirin, with a decrease from 4.5% to 1.4% annually. Inversely, the risk of hemorrhage on warfarin therapy is increased and rates of major hemorrhage historically were 1.3% versus 1% on placebo/aspirin.[7]

Warfarin use in AF is complex. Owing to concern for hemorrhage on warfarin therapy as well as need for monitoring of International Normalized Ratio levels at least once weekly during initiation, as well as once monthly when stabilized,[5] NOACs have been developed as a potentially safer and simpler alternative. Dabigatran is a direct thrombin inhibitor approved by the US Food and Drug Administration in 2010 for the prevention of stroke and systemic embolism in patients with nonvalvular AF. The Randomized Evaluation of Long-Term Anticoagulation Therapy (RE-LY) trial showed that dabigatran 150 mg twice daily therapy was superior to warfarin and 110 mg twice daily was noninferior to warfarin in the prevention of stroke for nonvalvular AF. Rates of major hemorrhage were similar to warfarin at 150 mg dosing and lower at 110 mg dose. Additionally, the annual rate of ICH was lower with dabigatran (0.10% for 150 mg; 0.12% for 110 mg) versus warfarin (0.38%).[8] Rivaroxaban, apixaban, and edoxaban are all factor Xa inhibitors also approved for the prevention of stroke in nonvalvular AF. Large-scale, randomized, controlled studies have also shown a significant decrease in the risk of ICH with the NOACs compared with warfarin.[9–11] A recent metaanalysis of these studies concluded that NOACs in combination with low dose-aspirin may be safer and more effective than warfarin in the prevention of stroke and vascular death and also have a lower incidence of ICH.[12]

Some studies have found that up to 37% of patients with ICH have concurrent AF.[13] Therefore, after determination of whether a patient is at risk for thromboembolism, this risk can then be weighed against scoring systems, which have been used to quantify the annual risk of hemorrhage. Various systems include $HEMORR_2HAGES$,[14] ATRIA,[15] ORBIT,[16] and HAS-BLED.[17] The HAS-BLED system (hypertension, abnormal renal/liver function [1 point for each], history of stroke, bleeding history or predisposition, labile International Normalized Ratio, elderly [age > 65 years], drug/alcohol use [1 point for each]) has demonstrated significant value in ability to predict ICH compared with the other models in patients taking both warfarin and NOACs.[18,19] It has also been useful in risk stratification of recurrence of ICH.[20]

Mechanical Heart Valves

Anticoagulation is recommended in all patients with mechanical heart valves (MHV), owing to their highly thrombogenic nature. Mechanical heart valves require warfarin therapy, and NOACs are not currently used for this indication. The annual risk of thromboembolism has been shown to be decreased from 22.0% to 2.2% in those with mechanical mitral valves and from 12.0% to 1.1% in those with mechanical aortic valves using anticoagulation.[21] A goal International Normalized Ratio of 2.5 to 3.0 is recommended in those with aortic valves and a goal of 3.0 is recommended in those with mitral valve. A daily dose of aspirin of 75 to 100 mg is recommended in these patients as well.[22]

Reinitiation of Anticoagulation in the Setting of Structural Disease After Neurosurgery

After a patient undergoes a neurosurgical procedure or suffers ICH secondary to anticoagulation, one of the most pressing issues regards reinitiation of therapy. The literature is lacking regarding this