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PERIOPERATIVE MANAGEMENT OF ANTICOAGULANT AND ANTIPLATELET THERAPY IN ELECTIVE NEUROSURGERY PATIENTS: A NARRATIVE REVIEW

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ABSTRACT:
Perioperative management is difficult in patients scheduled for elective cranial or spinal neurosurgery, as many patients are on chronic anticoagulation or antiplatelet therapy, which may increase the risk of bleeding complications. This article describes a risk-stratified perioperative approach to antithrombotic therapy. Important considerations include the indication for anticoagulation (e.g., atrial fibrillation, mechanical valves, recent stents), thrombotic risk scores (CHA_2DS_2-VASc, Caprini) and bleeding risk of the procedure. Warfarin is usually stopped 5 days before surgery, and reversal is performed using vitamin K and 4F-PCC in emergencies. DOACs are to be withheld 24-72 hours pre-op based on renal function and bleeding risk and with the availability of specific reversal agents idarucizumab, andexanet alfa. Anticoagulants, antiplatelet agents, including aspirin and $P2Y_{12}$ inhibitors, are managed dependent on surgical timing and stent history, and bridging is only indicated rarely. The guidelines recommend against routine bridging for anticoagulants and recommend individualized care. The report also associates an active antifibrinolysis with a favourable clinical outcome.16 Agreement within the neurosurgical community is for a longer preoperative hold period with antiplatelets because the likelihood of a hemorrhagic complication is greater in crossover patients than in those undergoing neurosurgical procedures. This structured approach, based on available evidence and expert opinion, is designed to maximise risk avoidance and benefit in the neurosurgical patient.

Keywords: Perioperative management, anticoagulant therapy, antiplatelet therapy, elective neurosurgery

Introduction

Patients undergoing elective cranial or spinal surgery are more frequently on chronic anticoagulant (warfarin or DOACs) or antiplatelet agents (aspirin, clopidogrel, ticagrelor), and this has led to a balance between the bleeding and thrombotic risks. Rigorous risk stratification and individualized management are warranted. Determinants for the recommendation of early heparin are indication for therapy (e.g. atrial fibrillation, mechanical valve, stent, prior VTE), patient thrombotic risk ($CHA2DS_2$-VASc; prior clot, hypercoagulability) and bleeding risk (neurosurgical dept., age, comorbidities). e.g. mechanical valves or stents in the last months have highly increased risk of developing thrombosis if treatment is e.g. temporarily interrupted; intracranial or major spinal surgery involve very high risk of bleeding. The risk of VTE (as high as ~8–25% DVT) after craniotomy is also considerable, especially for high-Caprini score patients (Caprini ≥5), and VTE after cranial neurosurgery can be predicted by the Caprini risk assessment model. On the other hand, there is a high risk even for minor remainig antiplatelet-effect to develop an abnormal neurosurgical hemorrhage (e.g. epidural hematoma). Management therefore needs to reconcile these competing risks in an eclectic manner.

Bleeding vs. Thrombotic Risk Stratification

That is, the risk of thrombosis in the neurosurgical patient is determined using standardized scores for medical risk, and patient history. Significant atrial fibrillation (CHA_2DS_2-VASc score ≥2) portends increased stroke risk; mechanical valves or recent (5 days off warfarin, but even that is case by case.

If rapid reversal is necessary (patient presents with INR still high), give IV vitamin K (5–10mg) plus 4F-PCC to rapidly normalize INR. PCC is favored over FFP because of less volume and a more rapid effect. (Guidelines suggest that 4F-PCC plus vitamin K should be administered in the setting of life-threatening bleeding or emergent neurosurgery. If hemostasis is secure, warfarin can be recommenced from 12 to 24 hours post-op. Some surgeons restart warfarin in the floor or clinic, some put the patient on subQ heparin until INR is back at therapeutic, but, again, bridging is typically avoided unless there is a high risk of valve thrombosis.

Direct Oral Anticoagulants (DOACs)

Direct oral anticoagulants (DOACs) (dabigatran, rivaroxaban, apixaban) have short half-lives and effect with a quick onset and offset, which makes it easier to use. For elective neurosurgery: hold DOACs~1-3days pre-op based on agent, renal function, and bleed risk. Under proposed use in the US – HOLD 24h pre-op for low-bleed-risk procedures; 48h for high-bleed-risk. For patients with decreased creatinine clearance (e.g., CrCl5 days) when TSH is used it should be therapeutic dose heparin discontinued hours before the procedure. Historically, prophylactic subQ heparin for VTE prophylaxis is ORDERED TO BE HELD until the 1st or 2nd post-op day.

Antiplatelet bridging:

There is no established antithrombotic bridging for antiplatelets. Some centres have experimented with ultra short-acting IV drugs for very high-risk patients. Cangrelor (IV reversible $P2Y_{12}$ blocker) has been explored as a bridging agent in short-term $P2Y_{12}$ blockade therapy, but is largely an experimental agent and not yet in common use in the perioperative context. GP IIb/IIIa inhibitors (eptifibatide, tirofiban) also could be considered intraoperatively or postoperatively in cases of urgent re-antiplatelet effect, although that is infrequent. As a rule, bridging antiplatelet therapy is not often practiced outside of selected centers.

Reversal Agents

Anticoagulants/antiplatelets are reversed for urgent/emergent situations (e.g., severe bleeding) or in emergency situations where surgery cannot be delayed (e.g., abscesses).

Warfarin:
In case INR is persistently high on the day of surgery: In the event that the INR is persistently high on the day of the surgery, administer IV VK (5–10mg) and 4F-PCC (25–50IU/kg) preoperatively. FFP is slower and volume-burdening; PCC + vitamin K is the treatment of choice. Recombinant factor VIIa should not be used routinely (neuro guidelines do not recommend it).

Dabigatran:
Give idarucizumab 5g IV for emergent reversal. This effectively reverses dabigatran within minutes.

Factor Xa inhibitors (rivaroxaban/apixaban/edoxaban):
Andexanet alfa is now approved for life-threatening bleeds on rivaroxaban/apixaban; use per label if neurosurgery is emergent. If this is not available, consider empirical 4F-PCC (50IU/kg). (Some treatment guidelines recommend FEIBA or activated PCC as other options.)

Antiplatelets:
Direct "reversal" is platelet transfusion (ie, getting fresh platelets that have not seen the drug). Although controversial, it may be used prior to emergent neurosurgery on antiplatelets in cases of massive hemorrhage. Desmopressin (DDAVP 0.3 mcg/kg) can provide a transient enhancement of platelet function and is occasionally employed.
All pin reversal is thrombotic risk, use only when necessary. In elective cases, the ideal is not reversal but avoidance of treatment.

Guidelines and Recommendations
There are many guidelines on perioperative antithrombotics (ASA, ESC, AHA/ACC, CHEST, neuro-anesthesia). Main consensus points include stop warfarin 5 days pre-op (INR check); stop DOACs 1–3 days pre-op, taking bleed risk into account; hold $P2Y_{12}$ inhibitors 5 days; and continue aspirin for most noncardiac surgeries. In 2022, the CHEST guidance recommended specifically against routine heparin bridging for warfarin or DOAC interruptions, even in high-risk patients, consistent with current practice. Neurological surgery guidelines specifically are not well-established, though practical neurosurgeon consensus typically tends to be a longer hold (e.g., 7–10 days for aspirin on spine) given the significant morbidity of a bleed. AAN/ASE/SCCM neuro-critical AAN/ASE/SCCM neuro-critical guidelines focus on emergency bleeds (e.g. ICH reversal).

Dual antiplatelet therapy specifically:
current ACC/AHA recommendation (as per a 2023 systematic review) is to delay elective surgery 6–12 months after stent placement and, if surgery is necessary sooner, maintain aspirin and discontinue $P2Y_{12}$ inhibitor. Following elective neurosurgery in patients with paucity [of symptoms] with stents, antiplatelets are re-started as safely as possible (often within 24–48h post-operative) to cover the vulnerable period.

Summary of Key Points
Risk stratification: Balance decision making using thrombotic-risk scores (CHA_2DS_2-VASc, Caprini) and surgeon-assigned bleed risk.
Warfarin: D/c ~5d pre-op; check INR; usually no bridging (CHEST 2022); For emergent reversal, give vitamin K + 4F-PCC; restart in post-op when stable.
DOACs: Cease 24–48h pre-op (longer if renal impairment); no bridging; specific reversal (idarucizumab, andexanet) or 4F-PCC if needed; restart ~24–72h post-op.
Aspirin: Usually discontinued ~7 days before craniotomy/spinal procedure but limited evidence that continuing doesn't significantly increase bleed risk. CHEST recommends continuation for noncardiac surgery, but neurosurgeons typically personalize. Resume early post-op.

Clopidogrel/Ticagrelor: Hold 5 days prior; prasugrel 7 days. No bridging in most cases. If patient has stent/DAPT, adjust care: postpone surgery if feasible, otherwise usually keep giving ASA and discontinue $P2Y_{12}$ only.

Bridging: Not usually beneficial for anticoagulants (no benfit, more bleed)—may consider for antiplatelets in rare situations (eg, GP IIb/IIIa infusion).
Discontinue if surgery can't be delayed. Warfarin reversal = vitamin K + PCCdabigatran = Idarucizumabfactor Xa = Andexanet or PCC Platelet transfusion can be considered for antiplatelet bleed.
By these means, driven by current neurosurgical practice and recent perioperative antithrombotic guidelines we are able to reduce bleeding complications and thrombotic events in elective neurosurgical patients to its possible minimum.

Sources: Key and practice-changing sources (CHEST 2022 guideline; Anesthesiology Reports 2022; Neurosurgical/anesthesia reviews; Neurocritical Care guidelines; and other as noted).

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