



# Anticoagulation

A quick guide  
before strabismus surgery.



- A** Agents & stop times
- B** Thrombotic & hemorrhagic risk
- C** Five-step perioperative pathway
- D** Intraoperative hemostasis

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QUICK REFERENCE

# When to Stop Before Surgery

Days before surgery that each agent is withheld, drawn from Table 1. Shaded cells show the days off therapy leading up to the operation.

|                          | 7 | 6 | 5 | 4 | 3 | 2 | 1 | Surgery       |
|--------------------------|---|---|---|---|---|---|---|---------------|
| Aspirin                  |   |   |   |   |   |   |   | 5–7 d         |
| Clopidogrel / Ticagrelor |   |   |   |   |   |   |   | 5 d           |
| Prasugrel                |   |   |   |   |   |   |   | 7 d           |
| Herbal supplements       |   |   |   |   |   |   |   | 7 d           |
| Warfarin                 |   |   |   |   |   |   |   | 5 d · INR<1.5 |
| Dabigatran*              |   |   |   |   |   |   |   | 24–48 h       |
| Rivaroxaban / Apixaban   |   |   |   |   |   |   |   | 24–48 h       |
| Edoxaban                 |   |   |   |   |   |   |   | 72 h          |
| LMWH                     |   |   |   |   |   |   |   | 24 h          |
| UFH                      |   |   |   |   |   |   |   | 1–2 h         |

■ Antiplatelet / supplement ■ Anticoagulant ■ Upper end of range

\* Dabigatran: 3–5 days if renal function is impaired. NSAIDs: by half-life (≈2 h ibuprofen, ≈17 h naproxen).

## N.B. Before you stop anything

When discontinuing antithrombotic medicines, consider both hemorrhagic and thrombotic risks. Before discontinuing anticoagulation, consult the patient's primary care practitioner or cardiologist to establish the risk level.

A

SECTION A

Know the Agents

Antiplatelet and anticoagulant drugs, how they act, how long they last and when to stop them before surgery.

Table 1 · Anticoagulant & antiplatelet agents

ANTIPLATELET AGENTS

Aspirin (ASA)

Acetylsalicylic acid

| MECHANISM                                                  | HALF-LIFE | CLEARANCE |
|------------------------------------------------------------|-----------|-----------|
| Irreversible COX inhibitor; reduces thromboxane production | 2–3 hours | Renal     |

STOP BEFORE SURGERY 5–7 days before surgery

NSAIDs

Ibuprofen, Naproxen, Ketorolac

| MECHANISM                | HALF-LIFE  | CLEARANCE |
|--------------------------|------------|-----------|
| Reversible COX inhibitor | 2–17 hours | Renal     |

STOP BEFORE SURGERY Depends on half-life (e.g., 2 hours for ibuprofen, 17 hours for naproxen)

ADP/P2Y12 inhibitors

Clopidogrel (Plavix), Prasugrel, Ticagrelor

| MECHANISM                                                  | HALF-LIFE | CLEARANCE |
|------------------------------------------------------------|-----------|-----------|
| Inhibit ADP receptors on platelets, preventing aggregation | 7–8 hours | Hepatic   |

STOP BEFORE SURGERY 5 days for clopidogrel/ticagrelor; 7 days for prasugrel

ANTICOAGULANT AGENTS

Heparin

Unfractionated heparin, LMWH

| MECHANISM                                                   | HALF-LIFE                         | CLEARANCE |
|-------------------------------------------------------------|-----------------------------------|-----------|
| Activates antithrombin III; inhibits thrombin and factor Xa | 1–2 hours (UFH); 4.5 hours (LMWH) | Renal     |

STOP BEFORE SURGERY 1–2 hours (UFH); 24 hours (LMWH)

Warfarin

Coumadin

| MECHANISM                                                      | HALF-LIFE   | CLEARANCE |
|----------------------------------------------------------------|-------------|-----------|
| Inhibits vitamin K–dependent clotting factors (II, VII, IX, X) | 36–42 hours | Renal     |

STOP BEFORE SURGERY 5 days before surgery; INR < 1.5

Direct thrombin inhibitors

*Dabigatran (Pradaxa)*

| MECHANISM                              | HALF-LIFE   | CLEARANCE |
|----------------------------------------|-------------|-----------|
| Directly inhibits thrombin (factor II) | 14–17 hours | Renal     |

STOP BEFORE SURGERY 24–48 hours (normal renal function); 3–5 days (impaired renal function)

Direct factor Xa inhibitors

*Rivaroxaban, Apixaban, Edoxaban*

| MECHANISM                   | HALF-LIFE  | CLEARANCE   |
|-----------------------------|------------|-------------|
| Directly inhibits factor Xa | 5–12 hours | Renal/Fecal |

STOP BEFORE SURGERY 24–48 hours (rivaroxaban/apixaban); 72 hours (edoxaban)

SUPPLEMENTS

Herbal supplements

*Garlic, Ginkgo biloba, St. John's Wort*

| MECHANISM                                  | HALF-LIFE | CLEARANCE |
|--------------------------------------------|-----------|-----------|
| Varying antiplatelet/anticoagulant effects | Variable  | Variable  |

STOP BEFORE SURGERY 7 days before surgery (case-by-case basis)

B

SECTION B

Weigh the Risks

Thromboembolic risk if therapy is stopped, against the hemorrhagic complications specific to strabismus surgery.

Table 2 · Perioperative thromboembolism risk

Risk if anticoagulation is interrupted

| HIGH RISK                                                                                                                                                                                      |                                                                                                                                                                          |                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>CARDIAC / VALVE</b></p> <ul style="list-style-type: none"><li>▪ Mitral valve prosthesis</li><li>▪ Caged-ball or tilting disc aortic valve</li><li>▪ Stroke/TIA within 6 months</li></ul> | <p><b>ATRIAL FIBRILLATION</b></p> <ul style="list-style-type: none"><li>▪ CHA<sub>2</sub>DS<sub>2</sub>-VASc score ≥2</li><li>▪ Stroke/TIA within 3 months</li></ul>     | <p><b>VTE</b></p> <ul style="list-style-type: none"><li>▪ VTE within 3 months</li><li>▪ Severe thrombophilia (e.g., protein C/S deficiency, antiphospholipid antibodies)</li></ul> |
| INTERMEDIATE RISK                                                                                                                                                                              |                                                                                                                                                                          |                                                                                                                                                                                    |
| <p><b>CARDIAC / VALVE</b></p> <ul style="list-style-type: none"><li>▪ Bileaflet aortic valve without stroke risk factors</li></ul>                                                             | <p><b>ATRIAL FIBRILLATION</b></p> <ul style="list-style-type: none"><li>▪ CHA<sub>2</sub>DS<sub>2</sub>-VASc score = 1</li><li>▪ Stroke/TIA within 3–12 months</li></ul> | <p><b>VTE</b></p> <ul style="list-style-type: none"><li>▪ Recurrent VTE</li><li>▪ VTE within 3–12 months</li><li>▪ Active cancer</li></ul>                                         |
| LOW RISK                                                                                                                                                                                       |                                                                                                                                                                          |                                                                                                                                                                                    |
| <p><b>CARDIAC / VALVE</b></p> <ul style="list-style-type: none"><li>▪ Bileaflet aortic valve without stroke risk factors</li></ul>                                                             | <p><b>ATRIAL FIBRILLATION</b></p> <ul style="list-style-type: none"><li>▪ CHA<sub>2</sub>DS<sub>2</sub>-VASc score = 0</li><li>▪ No recent stroke/TIA</li></ul>          | <p><b>VTE</b></p> <ul style="list-style-type: none"><li>▪ VTE &gt;12 months, no other risks</li></ul>                                                                              |

Table 3 · Hemorrhagic complications in strabismus surgery

Retrobulbar hemorrhage Vision-threatening

Vision-threatening hematoma; can occur with regional anesthesia or postoperatively.

**RISK FACTORS** Anticoagulation, high-dose garlic supplements, coughing/straining postoperatively.

Eyelid hemorrhage

Causes discomfort and cosmetic concerns; more common after inferior oblique muscle surgery.

**RISK FACTORS** Anticoagulation, surgical technique.

## Subconjunctival hemorrhage

Can lead to corneal dellen or perforation if not managed.

**RISK FACTORS** Anticoagulation, surgical technique.

## Muscle slippage

May require reoperation due to bleeding complications.

**RISK FACTORS** Anticoagulation, surgical technique.

C

SECTION C

Plan the Perioperative Path

A five-step decision pathway and the strategies that minimize bleeding before, during and after surgery.

Table 4 · Preoperative management pathway

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p><b>Assess hemorrhagic risk</b></p> <p><i>Evaluate patient and surgical factors.</i></p> <ul style="list-style-type: none"><li>▪ <b>Patient factors:</b> hypertension, renal/hepatic disease, bleeding disorders.</li><li>▪ <b>Surgical factors:</b> complexity, reoperations, anesthesia type.</li></ul>                                                                                                                                                                                                                                                                                                                |
| 2 | <p><b>Assess thrombotic risk</b></p> <p><i>Stratify patient risk (high, intermediate, low).</i></p> <ul style="list-style-type: none"><li>▪ <b>High risk:</b> mitral valve prosthesis, recent stroke/TIA, severe thrombophilia.</li><li>▪ <b>Intermediate risk:</b> bileaflet aortic valve with stroke risk factors, recurrent VTE.</li><li>▪ <b>Low risk:</b> bileaflet aortic valve without stroke risk factors, no recent stroke/TIA.</li></ul>                                                                                                                                                                         |
| 3 | <p><b>Decide whether to discontinue</b></p> <p><i>Decide whether to discontinue anticoagulant/antiplatelet therapy.</i></p> <ul style="list-style-type: none"><li>▪ <b>Low thrombotic risk:</b> discontinue without heparin bridge.</li><li>▪ <b>Intermediate/high risk:</b> consider heparin bridge or delay surgery.</li></ul>                                                                                                                                                                                                                                                                                           |
| 4 | <p><b>Time the discontinuation</b></p> <p><i>Determine when to stop medications before surgery.</i></p> <ul style="list-style-type: none"><li>▪ <b>Aspirin:</b> 5–7 days before surgery.</li><li>▪ <b>NSAIDs:</b> depends on half-life.</li><li>▪ <b>ADP/P2Y12 inhibitors:</b> 5 days (clopidogrel/ticagrelor), 7 days (prasugrel).</li><li>▪ <b>Warfarin:</b> 5 days before surgery, INR &lt;1.5.</li><li>▪ <b>Direct thrombin inhibitors:</b> 24–48 hours (normal renal function), 3–5 days (impaired).</li><li>▪ <b>Direct factor Xa inhibitors:</b> 24–48 hours (rivaroxaban/apixaban), 72 hours (edoxaban).</li></ul> |

5

Manage postoperatively

*Restart anticoagulation and monitor for complications.*

- Restart 24–48 hours after surgery (low hemorrhagic risk) or 48–72 hours (high hemorrhagic risk).
- Use local hemostatic agents (e.g., epinephrine, oxymetazoline) during surgery.

Table 5 • Surgical strategies to minimize bleeding

Preoperative optimization BEFORE

- Control hypertension.
- Discontinue anticoagulants/antiplatelets based on risk assessment.
- Avoid herbal supplements (e.g., garlic, ginkgo biloba) 7 days before surgery.

Intraoperative techniques DURING

- Use topical vasoconstrictors (e.g., epinephrine 1:10,000 or 1:1,000).
- Identify and cauterize conjunctival and ciliary vessels early.
- Use oxymetazoline-soaked cotton-tip applicators for blunt dissection.
- Suture muscles deep to vessels to avoid nicking.

Postoperative care AFTER

- Monitor for signs of retrobulbar hemorrhage (e.g., orbital compartment syndrome).
- Use minimal postoperative analgesia (e.g., acetaminophen; avoid NSAIDs in high-risk patients).

D

SECTION D

Control Bleeding in the OR

Local techniques for hemostasis, from topical vasoconstrictors to suturing deep to vessels.

Table 6 · Local control of hemostasis during surgery

Topical vasoconstrictors

- **Agents:** epinephrine, oxymetazoline.
- **Application:** applied topically to induce vasoconstriction.
- **Concentration:** 1:10,000 (100 mcg/mL) for routine cases; 1:1,000 (1000 mcg/mL) for high-risk cases.
- **Considerations:** risk of tachycardia and hypertension; discuss with the anesthesia provider if the patient has cardiovascular risks.

Cautery

- **Use:** early in surgery, during muscle isolation and suture placement.
- **Purpose:** prevents bleeding by cauterizing small vessels.
- **Technique:** cauterize before dissecting connective tissues with small vessels.

Blunt dissection

- **Tool:** oxymetazoline-soaked cotton-tip applicators, Viscodissection
- **Purpose:** minimizes bleeding during dissection.

Suturing technique

- **Strategy:** suture muscles deep to vessels to avoid inadvertent nicking.
- **Purpose:** reduces risk of bleeding from damaged vessels.

Hemostatic agents

- **Examples:** epinephrine-soaked sponges, thrombin-based agents, viscoelastic.
- **Use:** applied directly to bleeding sites for rapid hemostasis.

Minimizing tissue trauma

- **Technique:** gentle handling of tissues to avoid unnecessary bleeding.
- **Purpose:** reduces risk of hemorrhage, especially in anticoagulated patients.

REFERENCE

# Abbreviations

|                                        |                                                                                                  |
|----------------------------------------|--------------------------------------------------------------------------------------------------|
| ACAPT                                  | Anticoagulation and antiplatelet therapy                                                         |
| ADP                                    | Adenosine diphosphate                                                                            |
| ASA                                    | Acetylsalicylic acid (aspirin)                                                                   |
| CHA <sub>2</sub> DS <sub>2</sub> -VASc | CHF, Hypertension, Age ≥75, Diabetes, Stroke, Vascular disease, Age 65–74, Sex category (female) |
| CHF                                    | Congestive heart failure                                                                         |
| COX                                    | Cyclooxygenase                                                                                   |
| CrCl                                   | Creatinine clearance                                                                             |
| INR                                    | International normalized ratio                                                                   |
| LMWH                                   | Low-molecular-weight heparin                                                                     |
| MI                                     | Myocardial infarction                                                                            |
| NOACs                                  | Non-vitamin K oral anticoagulants                                                                |
| NSAIDs                                 | Non-steroidal anti-inflammatory drugs                                                            |
| P2Y12                                  | Platelet ADP receptor                                                                            |
| TIA                                    | Transient ischemic attack                                                                        |
| UFH                                    | Unfractionated heparin                                                                           |
| VTE                                    | Venous thromboembolism                                                                           |

## SOURCES

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## Disclosure

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