- Indications:
  - May be used to prevent pregnancy-associated and postop N/V.
  - Shows promise as therapy for postchemotherapy N/V.
  - May be used to alleviate dyspepsia and loss of appetite.
  - May have anti-inflammatory and antithrombotic effects.
  - Taken before exercise, 4 g of ginger significantly decreases muscle soreness.
  - May be useful as an insulin sensitizer.
  - May be useful in decreasing serum lipid and cholesterol levels.
  - Recent in vivo animal studies of ginger have shown cognition-enhancing effects and a possible role in treatment of dementia.
- Contraindications: Must be used carefully in combination with antiplatelet drugs, warfarin, or heparin owing to potential for increased bleeding risks.

Assessment Points

System	Effects (Based on Animal/Human Studies)	Assessment by Hx	PE
CV	Hypotensive Augments inotropic effect by increase in Ca efflux across sarcoplasmic reticulum Large doses may lead to cardiac arrhythmias		BP/HR
GI	Increases gastric and intestinal motility as well as gastric, bile, and salivary secretions Antiemetic May be hepatoprotective		
RESP	Antitussive		
HEME	Inhibits thromboxane synthetase Acts as a prostacyclin agonist	Herb use Symptoms of bleeding Antiplatelet agents, heparin, or warfarin	
CNS	Prolongs duration of anesthesia induced by barbiturates Antipyretic through prostaglandin inhibition Large quantities may cause central nervous system depression		

Key References: Ali BH, Blunden G, Tanira MO, et al.: Some phytochemical, pharmacological and toxicological properties of ginger: a review of recent research, *Food Chem Toxicol* 46(2):409–420, 2008; Grzanna R, Lindmark L, Frondoza CG: Ginger—a herbal medicinal product with broad anti-inflammatory actions, *J Med Food* 8(2):125–132, 2005.

Perioperative Implications

Preoperative Period
- Possible interaction with antiplatelet agents or warfarin

Induction
- May potentiate barbiturates.
- May potentiate hypotension.

Postoperative Concerns
- May increase bleeding complications.

Anticipated Problems/Concerns
- May increase bleeding complications when used with antiplatelet drugs, warfarin, or heparin.
- Consider avoiding use in the presence of gallstone conditions.
- May potentiate periop hypotension.
- May cause hypoglycemia, requiring adjustment of DM medication regime.

Ginkgo biloba

Jonathan G. Ma | Jonathan P. Eskander | Alan David Kaye

Uses
- Antioxidant and polyphenol properties.
- Improved cognitive performance in pts with Alzheimer disease, particularly short-term visual memory and speed of cognitive processing, for 6 mo to 1 y.
- Improved cognitive performance in vascular dementia and may be neuroprotective in pts with preexisting cerebral ischemia.
- Used to improve symptoms of intermittent claudication, Raynaud phenomenon, and acrocyanosis. Evidence for effectiveness is debated.
- *Ginkgo biloba* extract (GBE) used in pts with normal-tension glaucoma and those with early diabetic retinopathy, improving measures of colored vision; also possibly effective in treating age-related macular degeneration, symptoms of vertigo and other equilibrium disorders, depression, anxiety, and vitiligo.
- GBE is believed to work via the dopaminergic system, which modulates prolactin secretion. One study has shown that it enhances the copulatory behavior of male rats.

Perioperative Risks
- Increased risk of bleeding and drug interactions; therefore the ASA recommends stopping 2–3 wk prior to surgery since the half-life of a given ginkgo preparation is unknown.
- Lack of safety data in certain populations; therefore not recommended for use in pregnancy, breastfeeding, and in children <12 y of age.
- Commonly reported side effects include N/V and diarrhea, headache, and bleeding.

Worry About
- Spontaneous bleeding can occur related to the inhibition of platelet aggregation.
- Risk of bleeding is further increased if combined with antithrombotic drugs (aspirin, NSAIDs, clopidogrel, dipyridamole), anticoagulant drugs (heparin, enoxaparin), and other herbal medicines known to increase bleeding (ginger, garlic, ginseng). Recent studies show that coagulation parameters were unchanged when GBE was coadministered with warfarin.
- Can decrease the effectiveness of numerous anticonvulsants (valproate, carbamazepine, phenobarbital, primidone, gabapentin, phenytoin); also ginkgotoxin, which is contained in a far greater concentration in the seeds, can cause seizures; anecdotal reports of seizure occurring after pts with and without epilepsy Hx took ginkgo leaf; finally, ginkgo has been shown to decrease alprazolam levels by 17% when GBE 120 mg taken 2 times daily.
- May enhance the effects of MAO inhibitors (phenelzine, selegiline, tranylcypromine) and increase the risk of serotonin syndrome when taken with SSRIs.
- Interactions have also been reported with CCBs, trazodone, acetylcholinesterase inhibitors, blood glucose–lowering medications, insulin, drugs for erectile dysfunction, and thiazide diuretics.
- Animal studies have shown that GBE induces pathologic changes in liver, thyroid gland, and nose, most notably an increase in liver tumors and thyroid gland follicle cell tumors. No human studies to verify these findings.

Overview
- Ginkgo (*Ginkgo biloba*) is one of the oldest tree species and GBE is one of the most common supplements used worldwide. Several extracts have been isolated.

Drug Class/Mechanism of Action/Usual Dose
- Active elements responsible for ginkgo's medicinal effects incl ginkgo flavone glycosides and terpene lactones, both obtained from the dry leaves.
- Extracts standardized to contain 24–27% of ginkgo flavone glycosides and 6% terpenes are commonly found in 40- to 80-mg oral capsules and recommended 3 times daily.
- Ginkgo has a wide range of properties: Antagonism of platelet activating factor, lowering of serum fibrinogen levels, stimulation of endothelium-derived relaxing factor, facilitation of prostacyclin release, and inhibition of nitric oxide.
- CNS effects are mainly attributed to ginkgo's antioxidant characteristics. By causing a decrease in superoxide release and acting as a scavenger of free radicals, ginkgo helps to prevent hypoxic damage to

brain tissue and improves cerebral metabolism. O_2 utilization in the brain may be improved and age-related changes in the animal hippocampus may be prevented.
- Additional studies indicate that ginkgo reversibly inhibits MAO-A and MAO-B, inhibits acetylcholinesterase, and decreases adrenal benzodiazepine receptors.
- Studies have shown that coadministration of warfarin with GBE or ginkoglide B (a platelet activating factor antagonist) influenced blood coagulation parameters. Ginkgo and its extracts were shown not to affect the clearance of warfarin enantiomers, suggesting that the herb does not significantly influence CYP1A2, CYP3A4, or CYP2C9 activity.

Assessment Points

System	Effect	Assessment by Hx	PE
HEENT	Increased ocular blood flow	Bleeding	Mucosal bleeding
CV	Vasodilation		BP/HR
HEME	Inhibition of platelet aggregation	Bleeding, bruising	Mucosal bleeding Petechiae
GI	N/V, diarrhea		
CNS	Increased cerebral blood flow Headache	Headache	
DERM	Contact dermatitis	Exposure	Rash

Key References: Jiang X, Williams KM, Liauw WS, et al.: Effect of ginkgo and ginger on the pharmacokinetics and pharmacodynamics of warfarin in healthy subjects, *Br J Clin Pharmacol* 59(4):425–432, 2005 ; Yeh KY, Pu HF, Kaphle K, et al.: *Ginkgo biloba* extract enhances male copulatory behavior and reduces serum prolactin levels in rats, Horm Behav 53(1):225-231, 2008 (epub 2007); Marcilhac A, Dakine N, Bourhim N, et al.: Effect of chronic administration of *Ginkgo biloba* extract or Ginkgolide on the hypothalamic-pituitary-adrenal axis in the rat, *Life Sci* 62(25):2329-2340, 1998.

Perioperative Implications

Preoperative Concerns
- Outside of potentially increased risk of bleeding, periop concern with ginkgo intake revolves around drug interactions.
- Minimal data on effects in pregnancy, breastfeeding, and pediatrics.
- Many pts do not account for alternative medicines when asked for medication lists by their physician.
- Inhibition of platelet aggregation can result in significant intraop bleeding; thus ginkgo should be D/C at least 36 h before elective surgery.

Monitoring
- Routine

Airway
- Avoid nasal intubation to minimize intranasal bleed.

Preinduction/Induction
- Avoid excessive hypotension with induction agents because ginkgo's subtle vasodilatory effects can further decrease BP; effects on the adrenal receptors minimize a normal stress response. Hence prolonged and excessive hypotension can jeopardize perfusion of vital organs.

Maintenance
- Side effects can be amplified with concomitant use of interacting drugs. Such concerns include bleeding, hypotension, seizures, sedation, serotonin syndrome, and cholinergic crisis.

Extubation
- No known concerns

Postoperative Period
- Avoid administering classes of drugs that may interact with ginkgo and potentiate its effects, as previously mentioned.

Novel Therapies
- Can improve cerebral oxygen supply, decrease cerebral oxygen extraction rate and consumption, reduce cerebral oxygen metabolic rate, and maintain balance of cerebral oxygen supply and demand in elderly pt with preexisting cerebral ischemia.
- May ameliorate neuropathic pain by scavenging reactive oxygen species, contribute to hypersensitivity neuropathic pain.

Ginseng

James G. Hilliard | Jeffery R. Kirsch

Uses
- Ginseng has been used for more than 2000 y in Chinese herbal medicine for a variety of proposed health benefits.
- Used as an adaptogen, it is believed to increase the body's resistance to stress and fatigue.
- Known to have antistress, antifatigue, antiviral, antifungal, antineoplastic, neuroprotective, and antihyperglycemic effects

Perioperative Risks
- Ginseng blocks morphine in a non–opioid-dependent manner.
- Ginseng has the ability to lower postprandial blood glucose in both pts with diabetes type 2 and nondiabetic pts.
- Ginseng may promote bleeding in surgical pts. Ginsenosides (the active ingredients) in American ginseng have been shown to inhibit platelet aggregation. Studies in lab rats show prolongation of the coagulation time of thrombin and activated partial thromboplastin. One study suggests that the antiplatelet activity of panaxynol, a constituent of ginseng, may be irreversible in humans. Given these findings, it may be prudent to recommend that pts discontinue ginseng use at least 7 d prior to surgery.

Worry About
- Reduced efficacy of opioids and unpredictable dosing requirements of analgesics.
- The development of hypoglycemia, especially in diabetic pts taking insulin or oral antihyperglycemic agents.
- May have additive effects when used with corticosteroids and may intensify the side effects of corticosteroids.
- May lead to development of headache, tremors, and manic episodes when used in pts receiving MAO inhibitors such as phenelzine.
- Interferes with the pharmacodynamics and drug-level monitoring of pts taking digoxin and may increase digoxin levels.
- May increase the risk of surgical bleeding owing to its antiplatelet effects and inhibition of the coagulation cascade.
- May have estrogen-like effects and should be avoided in pregnant or breastfeeding women and in children. Avoid the use of ginseng in pts with hormone-sensitive conditions, such as breast cancer, uterine cancer, or endometriosis.
- Consumption can increase and/or decrease BP. Caution should be used in those with hypertension or hypotension.

Overview
- *Ginseng* refers to several species of the genus *Panax* and comprises a family of plants (American ginseng, Asian ginseng, Chinese ginseng, Korean red ginseng, *Panax ginseng*: *Panax* spp., including *P. ginseng* C.C. *Meyer*, and *P. quinquefolius L.*, excluding *Eleutherococcus senticosus*).
- Dietary supplements are typically derived from American ginseng (*Panax quinquefolius*) or Asian ginseng.
- Siberian ginseng (*Eleutherococcus senticosus*) is a different genus and does not contain the ingredients believed to be active in the two forms used in supplements.
- Ginseng can be taken as fresh or dried roots, extracts, solutions, capsules, tablets, sodas, and teas; also used as a cosmetic agent.

Drug Class/Mechanism of Action/Usual Dose
- The active ingredients in American ginseng are panaxosides (saponin glycosides). The active ingredients in Asian ginseng are ginsenosides (triterpenoid glycosides).
- Most of the pharmacologic actions of ginseng are attributed to the ginsenosides belonging to a group of compounds known as *steroidal saponins*.