

Anticoagulants and Diving



What Are Anticoagulants?

Anticoagulants are drugs or substances that cause the blood to clot more slowly when out of the blood vessel; examples would be coumadin (Warfarin, Dicoumarol) and heparin. These medications are given specifically for this effect in order to prevent intravascular clotting. Other medications have this effect on divers as a specific side effect; for example, aspirin and NSAIDS (ibuprofen), through their effect on blood platelets, making them less sticky.

Why is this important to divers?

For divers, the most important question is not whether they are on blood thinners, but if the **condition** for which the coumadin is being used is adverse to diving. Often, the illness is under good control and does not interfere with safe sport diving. Factors important to diving with Coumadin depend on the disease process that could be inimical to diving, how well the clotting time is controlled, careful clearing techniques to avoid bleeding from ear and sinus barotrauma, and knowledge of interactions from other drugs and foods which cause changes in the effects of the anticoagulant.

Divers on [blood thinners](#) risk bleeding from injury, ear, sinus and pulmonary barotrauma. A cut will bleed longer and may require compression for control; an ear or sinus squeeze will cause excess bleeding if the squeeze is severe enough to cause damage to blood vessels in the middle ear, sinuses or lungs.

When are blood thinners used in medicine?

Coumadin is used when there is a risk of blood clotting due to illness (cancer), artificial heart valves, certain abnormal heart rhythms and defibrillators, pacemakers or disease of the veins (phlebitis). There are many thousands of people taking Coumadin to prevent blood clotting. All people taking Coumadin must have a blood test periodically (usually monthly) to determine if level of anticoagulation is properly maintained. The physician uses a measured blood clotting time called the International Normalized Ratio (INR). This ratio compares the clotting time of an individual's blood to a standard. The normal ratio is one. Ratios of 2-2.5 are used in some cases of vein disease or abnormal heart rhythms while in the case of heart valves, the ratio is maintained at 2.5-3.5 to minimize risk of blood clotting.

Coumadin reduces the ability of the blood to clot by blocking the effects of vitamin K. This vitamin is important in producing one of the clotting factors (prothrombin) needed for blood to clot. By lowering the amount of prothrombin, clotting time is prolonged. Certain antibiotics can kill off bacteria in the bowel causing a reduction in Vitamin K and increase the effects of Coumadin.

Drugs, illness or dietary change can also affect the level of blood clotting when taking Coumadin. Aspirin should be avoided when taking Coumadin because aspirin blocks a backup clotting mechanism which depends on the blood platelets, and leaves no protection against bleeding.

Many divers take Coumadin and dive without difficulty. Safe use of Coumadin requires careful attention to the INR, with monthly blood tests, and watchful management by the physician. With good control of blood thinning, the risk of a bleeding complication is quite low.

The only effect that diving while on anticoagulants will have on you is the increased chance of bleeding and internal hematomas from trauma. Diving and pressure changes should have no different effect on you than the average person. This risk is probably not as great with heparin-type medications as with coumadin.

There could be an increased hazard of clotting due to constrictive clothing and equipment.

Anti-coagulants represent a 'relative contra-indication' to diving and the decision to dive or not depends to a great extent on your own comfort level.

Some information about Coumadin

Adverse Reactions of Warfarin (Coumadin):

Potential adverse reactions to warfarin sodium may include:

Fatal or nonfatal hemorrhage from any tissue or organ: This is a consequence of the anticoagulant effect. The signs, symptoms, and severity will vary according to the location and degree or extent of the bleeding. Hemorrhagic complications may present as paralysis; paresthesia; headache, chest, abdomen, joint, muscle, or other pain; dizziness, shortness of breath, difficult breathing or swallowing; unexplained swelling; weakness; hypotension; or unexplained shock.

Therefore, the possibility of hemorrhage should be considered in evaluating the condition of any anticoagulated patient with complaints which do not indicate an obvious diagnosis. Bleeding during anticoagulant therapy does not always correlate with PT/INR .

Bleeding: which occurs when the PT/INR is within the therapeutic range warrants diagnostic investigation since it may unmask a previously unsuspected lesion, e.g., tumor, ulcer, etc.

Necrosis of skin and other tissues.

Adverse reactions reported infrequently include: Hypersensitivity reactions, systemic cholesterol microembolization, purple toes syndrome, vasculitis, hepatitis, cholestatic hepatic injury, jaundice, elevated liver enzymes, fever, dermatitis, including bullous eruptions, urticaria, abdominal pain including cramping, asthenia, nausea, vomiting, diarrhea, headache, pruritis, alopecia, and paresthesia.

Rare events of tracheal or tracheobronchial calcification have been reported in association with long-term warfarin sodium therapy. The clinical significance of this event is unknown.

Priapism has been associated with anticoagulant administration, however, a causal relationship has not been established.

Overdosage:

Signs and Symptoms: Suspected or overt abnormal bleeding (e.g., appearance of blood in stools or urine, hematuria, excessive menstrual bleeding, melena, petechiae, excessive bruising or persistent oozing from superficial injuries) are early manifestations of anticoagulation beyond a safe and satisfactory level.

Treatment: Excessive anticoagulation, with or without bleeding, may be controlled by discontinuing warfarin sodium therapy and if necessary, by administration of oral or parenteral vitamin K1. (Please see recommendations accompanying vitamin K1 preparations prior to use.)

Such use of vitamin K1 reduces response to subsequent warfarin sodium therapy. Patients may return to a pretreatment thrombotic status following the rapid reversal of a prolonged PT/INR. Resumption of warfarin sodium administration reverses the effect of vitamin K, and a therapeutic PT/INR can again be obtained by careful dosage adjustment. If rapid anticoagulation is indicated, heparin may be preferable for initial therapy.

If minor bleeding progresses to major bleeding, give 5 to 25 mg (rarely up to 50 mg) parenteral vitamin K1. In emergency situations of severe hemorrhage, clotting factors can be returned to normal by administering 200 to 500 ml of fresh whole blood or fresh frozen plasma, or by giving commercial Factor IX complex.

A risk of hepatitis and other viral diseases is associated with the use of these blood products; Factor IX complex is also associated with an increased risk of thrombosis. Therefore, these preparations should be used only in exceptional or life-threatening bleeding episodes secondary to warfarin sodium overdose.

Purified Factor IX preparations should not be used because they cannot increase the levels of prothrombin, Factor VII and Factor X which are also depressed along with the levels of Factor IX as a result of warfarin sodium treatment. Packed red blood cells may also be given if significant blood loss has occurred. Infusions of blood or plasma should be monitored carefully to avoid precipitating pulmonary edema in elderly patients or patients with heart disease.

Venous Thrombosis and Coumadin

Varicosities are usually caused by defective valves in the veins of the lower extremities and this is thought to be inherited. There is one other cause -- obstruction of the veins in the abdomen from tumors or growths (as in pregnancy). Varicosities can also occur in the arms due to blockage from tumor, clots in the deep veins, or trauma.

I have never heard of varicosities being caused by diving or any diving activities. Diving is not contra-indicated by the presence of varicosities, nor are varicosities worsened by diving.

As you are probably aware, Coumadin (Warfarin) is a vital part of the treatment of deep vein

thrombosis and several other conditions due to its anticoagulant effect. Its use is a two edged sword, however, because of the uncontrolled bleeding that can occur with the slightest trauma. Factors that should be considered in evaluating the relationships between drugs and diving include the following:

- **The condition/illness/disease for which the medication is being given.**
- **Any side effects that could be dangerous underwater.**
- **Any effects of the drug that alter consciousness or cause alteration in decision making ability.**
- **Complex relationships between drugs, the individual, other medications, diet and the conditions for which the drugs are taken.**

Diving with DVT could be hazardous because of the constricting effect of the equipment, belts and wet suits on the superficial veins. The effect of weightlessness on peripheral blood flow could be another unknown, with possible increased flow due to lack of gravity. I know of no studies on this question. Immersion does cause a central migration of body fluid, thereby possibly lessening peripheral edema and the peripheral venous load.

Every diver has minor trauma that is usually of little consequence. This can become a major problem if the diver is on anticoagulants. I've had patients (non divers) who required major hematoma evacuations due to very little injury. I believe that this is the main reason that most diving medicine authors advise not diving while on the drug. There is one other diving-related problem with Coumadin--barotrauma. Minor bleeding in the nose, sinuses and lungs can be greatly magnified while on the drug.

The effect of Dicoumarol on the bubble-platelet process is interesting; this may be a beneficial effect and could be protective, as is thought of Aspirin. Certainly no one is going to consider using Coumadin as a preventative for decompression illness or any of the other problems caused by breathing inert gases at pressure.

Most authorities (Bove, Davis, DAN, etc.) agree that diving with coumadin is either a relative contra-indication or absolute contraindication to diving.

The diagnosis of DVT does not in itself constitute a diving danger (except maybe for the constrictions of gear and wet suits)---but the bleeding hazards are several. Divers are certainly

prone to barotrauma of the air containing portions of the body (middle ears, sinuses, lungs, gut) and relatively slight barotrauma can cause significant bleeding even in the normal diver. Coumadin would certainly aggravate this occurrence.

Another consideration is the usual relatively small risk for blunt trauma in scuba diving. This does occur, however, and as is well known, coumadin is an extremely dangerous drug in this respect. You only have to have taken care of one giant hematoma to have great respect for what coumadin can do!

My feeling is that a commercial or rescue diver on coumadin would place himself and his buddies (and the EMS system) in jeopardy if he were to participate in diving. He would not be in a position to 'call his shots' and control his diving but would have to take on all comers.



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