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Ancient Chinese Herb Cures Cancer?

Can a Chinese herb cure cancer? Could an herb that kills cancer cells also be safe? The answer to these two questions is "Maybe." Two bioengineering researchers at the University of Washington may have discovered an effective treatment for cancer that Chinese herbalists have used to treat malaria for over two thousand years. That herb, known as "artemisinin", "sweet wormwood" or "Qinghaosu" is receiving exuberant attention on websites and Internet chat rooms. Some veterinarians are advising their clients to administer arteminisinin to their dogs with cancer either instead of, or in addition to, chemotherapy. A study is currently underway in Washington, DC, to analyze the effects of this herb on canine cancer patients. Until those results become available, how should veterinarians field questions from clients interested in a non-toxic cancer therapy? Very carefully.

In 2001, University of Washington research professor Henry Lai and assistant research professor Narendra Singh published a study in *Life Sciences* in which they reported that artemisinin kills breast cancer cells selectively with only minimal impact normal breast cells. Their idea to consider a schizonticide for cancer treatment stemmed from analyzing the means in which artemisinin kills the malarial parasite. Parasitized erythrocytes rapidly uptake artemisinin. The artemisinin interacts with a component of hemoglobin degradation and generates cytotoxic free radicals. In the case of malaria, these free radicals kill the single-cell Plasmodium parasite. Lai hypothesized that this same process might work to treat cancer, as cancer cells exhibit higher concentrations of iron than normal cells do, in order to support their destructive replication. Lai's ensuing experiments validated his suspicion.

In their early experiments in 1995, Singh and Lai, in collaboration with other researchers, reported in *Cancer Letters* that an artemisinin derivative called dihydroartemisinin worked in combination with holotransferrin to significantly retard the growth rate of implanted fibrosarcoma in rats, with no apparent toxicity or weight loss following treatment. (Holotransferrin was used to increase the ferrous iron concentration in the cancer cells.) Lai and Singh further demonstrated that this combination caused rapid cell death in a human leukemia cell line, with significantly less cell death in normal human lymphocytes. In their 2001 study on radiation-resistant breast cancer cells, dihydroartemesinin effectively killed radiation-resistant breast cancer cells *in vitro*, with dramatically less cytotoxicity on normal human breast cells. According to a University of Washington press release [November 26, 2001], "After eight hours, just 25 percent of the cancer cells remained. By the time 16 hours had passed, nearly all the cells were dead." Lai and Singh promote the idea that artemisinin-like compounds combined with iron-enhancing products may offer simple, effective, economical ($2 per dose), and relatively safe cancer treatment. Furthermore, a 2004 publication in the *Cancer Chemotherapy and Pharmacology* journal indicates that artemesinin also has antiangiogenic effects by 1) inducing cellular

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apoptosis and 2) by inhibiting expression of vascular endothelial growth factor receptors.

Is this herb as effective in non-human animals with cancer? The aforementioned press release alluded to a canine treatment in which, in "an earlier study, a dog with bone cancer so severe it couldn't walk made a complete recovery in five days after receiving the treatment." Another commentary adds further details on this patient: "Within five days of treatment the dog was able to walk normally, and X-rays (*sic*) confirmed the disappearance of the tumor. Several dogs with lymphosarcoma had also been treated with artemisinin with an immediate reduction in tumor size."

Lai attributes evidence of the safety of artemisinin to its longevity as an antimalarial drug. "[W]ith the millions of people who have already taken artemisinin for malaria, we have a track record showing that it's safe." But, is it safe for dogs? Artemisinin crosses the blood-brain barrier, and intramuscular injections of oil-soluble preparations of widely used artemisinin derivatives sometimes cause selective damage to brain stem centers which govern auditory processing and vestibular reflexes. Similar patterns of destruction occur in rodents and monkeys as well. This selective neurotoxicity occurs less frequently, if at all, following either oral administration, but the consistency of findings among experimental animals regarding the neurotoxicity of these compounds worries some investigators. Questions linger regarding the potential for neuropathologic changes to occur in patients receiving these compounds even at lower doses. This degradation may take place without observable functional deficit, making detection difficult.

Additionally, minimal adverse effects reported after long-term dosing in for humans receiving artemisinin for its antimalarial activity do not necessarily equate to safety for anti-cancer treatment in non-humans. In a 2004 review reported in *Toxicology Letters* entitled, "Artemisinin derivatives: toxic for laboratory animals, safe for humans?", Gordi and Lepist conclude, "[T]he observation of the toxicity of artemisinin compounds in animals, but not in humans, is most likely due to different pharmacokinetic profiles after different routes of administrations."

How safe, then, is this anti-cancer "smart bomb" for dogs, when at least one toxicology researcher estimates that the "probable order" of its neurotoxicity effects across species is, in his estimation, "dog>rat>monkey"? Veterinary clients desperately seeking alternative cancer treatments need accurate toxicity information. Veterinarians prescribing herbs such as artemisinin should also realize that if they practice in a state that excludes herbal medicine from their practice acts' definition of veterinary medicine, they may no longer be covered under their professional liability insurance for this activity. Insurance companies such as the AVMA Professional Liability Insurance Trust rely upon individual states' governing authority to regulate professional veterinary services as defined

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by each state's practice act. This means that, for example, if a veterinarian in the State of Georgia, which in 2003 exempted homeopathy and botanical medicine from the definition of veterinary medicine, prescribes artemisinin for a dog with cancer, he or she may be doing so without the benefit of malpractice coverage. A neurotoxic effect in a dog receiving this treatment could thus be detrimental to both the patient and the prescribing veterinarian.