Complementary Approaches: Dichloroacetate (DCA)

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Classification

Dicholoroacetates are salts of dichloroacetic acid. Both the salt and acid are man-made chemicals. DCA is a by-product of the chlorine disinfection of water.1, 2 DCA is a powder that can be made into pill form.



Dichloroacetic acid is typically manufactured for industrial purposes. Because the acid form (shown above) causes severe burns, only the salt, sodium dichloroacetate (DCA), is being studied as a possible drug.3 In the late 20th century, DCA was found to decrease high blood sugar levels in diabetics.4 DCA blocks a key enzyme (pyruvate dehydrogenase kinase) in the metabolic pathway that produces usable energy from sugar.5

Scientific Research

DCA and metabolic disorders

Because of its effects on how sugar is used by the body, DCA has been/is being studied as a possible treatment for some metabolic diseases, including lactic acidosis.5, 6, 7

DCA and cancer treatment

DCA's effects on energy production pathways led to studies examining the effects of DCA on cancer cells in animals and people (*in vivo*) and in the laboratory (*in vitro*). The work has focused on the chemical's ability to block an abnormal metabolic process that occurs in many cancer cells (called aerobic glycolysis or the "Warburg effect") and to "reactivate" nonfunctional mitochondria.8, 9, 10, 11, 12 Studies suggest that DCA-mediated changes lead to reduced blood vessel development (angiogenesis) in tumors.9, 13

DCA's anti-cancer activity has been studied with cells (and a few patients) from a number of cancer types, including lung carcinoid,14 breast cancer,15 neuroblastoma,16 prostate cancer,17 multiple myeloma,11 kidney cancer,18 and endometrial cancer.19 It seems to exert potent anti-cancer effects especially in conjunction with Metformin.20, 21

DCA may even be used in combination with standard treatments. Research suggests that it can increase the effectiveness of radiation on cancer cells,22 decrease the side effects associated with chemotherapy,23 and prevent cancer from recurring after surgery.24

Cancer cells from different types of cancer (i.e. breast vs lung vs liver) and even those from the same patient can be very different from each other. Research with neuroblastoma suggests that the differences seen between cancer cells can affect the effectiveness of DCA. As an example, the chemical has greater effects on undifferentiated, fully proliferating, more malignant neuroblastoma cancer cells than on differentiated and less malignant cells of the same type.16

However, in some systems DCA has been shown to PROTECT cancer cells from death. In research with colon cancer cells, DCA prevented the death of the cells in the laboratory and in animals.25 In mice with neuroblastoma, DCA enhanced the growth of tumor cells.26 Another study showed mixed results: DCA did not slow down tumor growth in mice, though it did make it harder for cancerous cells to spread (metastasize).27

DCA and the immune system

The effects of DCA on the immune system are being studied and are not yet clear. One study suggests that DCA may decrease the immune response against cancer by altering the activity of T lymphocytes, while other research has shown that DCA could increase immune function in tumors by reducing lactic acid levels in the tumor environment.28, 29

Clinical Trials

Despite the research done so far, relatively little is known about DCA as a cancer treatment in patients. A Canadian trial on 5 glioblastoma patients demonstrated some responses, but the information is difficult to interpret because the patients were also given other treatments and/or had failed previous treatments.30 There is a single report of a

patient with non-Hodgkin's lymphoma who entered remission after treatment with DCA (after failing to respond to treatment with chemotherapy).[31] Currently, there are several active clinical trials examining the effects of DCA on different cancer types. Some Phase I trials are complete, but study results have not been posted.[32]

View DCA clinical trials for cancer.

Side effects of DCA

A potentially dangerous side effect of DCA treatment is nerve damage (peripheral neuropathy). The mechanisms by which DCA induces peripheral neuropathy are not completely known, but DCA-induced neuropathy often limits the use of DCA in the treatment of patients.[30, 33]

DCA as a potential cancer causing agent (carcinogen)

According to the U.S. Environmental Protection Agency (EPA), DCA is carcinogenic in laboratory mice and rats. Several studies have shown that DCA causes cancer in lab animals.[34, 35, 36] There have not been enough studies to determine whether DCA causes cancer in humans, but based on the results in animals, the EPA considers it â€˜likelyâ€™ that DCA can cause cancer in humans.[37]

US Food and Drug Administration Approval

There is not enough evidence that dichloroacetate is effective in the fight against cancer, and it has not been approved by the FDA for cancer treatment.

Please be sure to see our notice on complementary therapies. To better understand and evaluate the research described above, read our Introduction to Scientific Research.

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