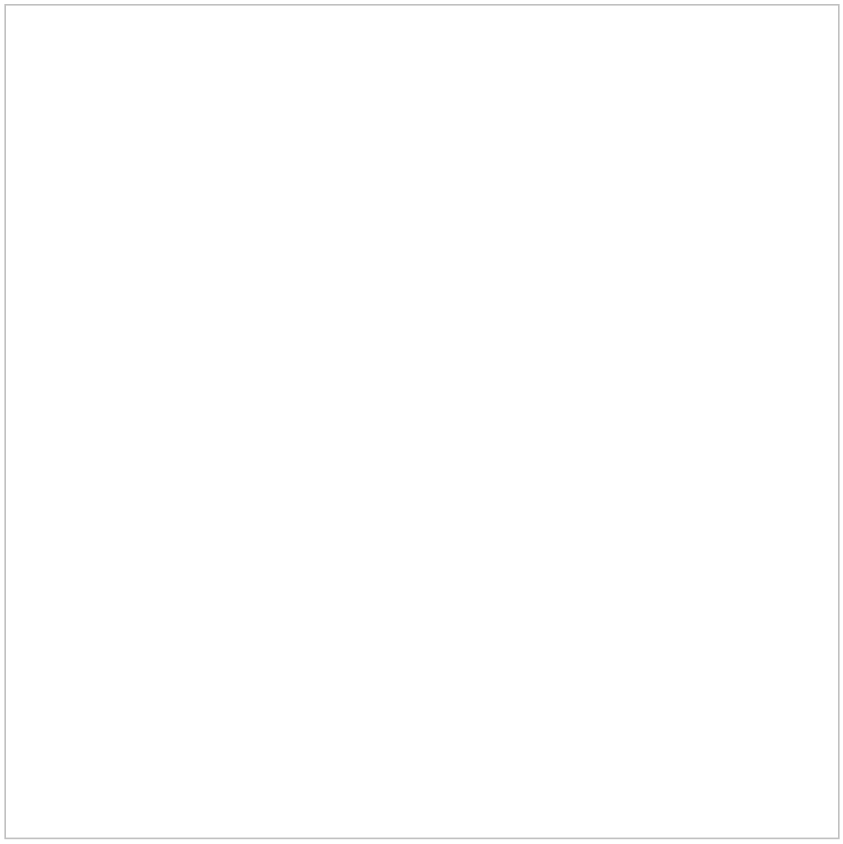
Complementary Approaches: Shark Cartilage (Neovastat®)



Intro and Background
Cartilage is the flexible, bone-like structure found in animals and humans. This tissue is nonvascular, which means it naturally prevents blood vessels from forming around it. The basis for cancer treatment with cartilage spawned from the notion that if a tumor could not obtain nutrients from the body, via blood vessels, it would shrivel and die. Animal cartilage was hypothesized to block tumor blood supplies. Sharks were targeted in the search for cartilage because their skeletons are mainly composed of cartilage. 1 The claim by I. William Lane that "sharks do not get cancer" also increased excitement over the treatment and led to a subsequent decline in shark populations in the wild. 2

The effectiveness of the treatments is unclear. Shark cartilage has not been approved by the FDA for the treatment of any disease, but it is available in the form of dietary supplements.3 The use of shark cartilage in cancer treatment is based on the mistaken belief that sharks don't get cancer. An extension of this belief is that shark body parts (i.e. cartilage) can prevent or treat cancer in humans. However, benign and cancerous tumors can in fact develop in sharks; George Washington University Medical Center researchers reported over thirty tumors found in elasmobranchs, a group of animals that includes sharks, rays, and skates.4 **The belief that sharks do not get cancer is not based on known facts.**

Another question that has been posed is: Do sharks develop cancer less frequently? This is a difficult question to answer because data concerning cancer rates in wild animals (including sharks) are limited, and the information that is available isn't conclusive. Some data suggest that sharks *may* have a reduced occurrence of cancer5 Some people interpret this to mean that sharks have some form of resistance to the development of cancer. If sharks do have lower cancer rates, the reasons are not understood.

Why Cartilage?
The choice of cartilage is not random. The first reason is the availability of the product. The entire endoskeleton of sharks is composed of cartilage, amounting to about six percent of their body weight.6 The amount of cartilage that can be obtained from a large shark is therefore quite large. The second reason is based on some proven biology. Cartilage, in both sharks and humans, lacks blood vessels. It has been suggested that sharks resist cancer because of something in their cartilage that inhibits blood vessel growth (angiogenesis). Angiogenesis inhibitors have been found in the cartilage of other animals7

Growing tumors require angiogenesis to bring them oxygen, sugar and other nutrients. Without a blood supply, tumors cannot grow beyond a very small size. Blood vessels also serve as a "highway" for cancer cells to move to distant parts of the body (metastasize). Angiogenesis inhibitors from other sources are already used to treat cancer patients. If they exist, it is possible that the angiogenesis inhibitors in shark cartilage could be used create a drug to combat cancer in humans.

Scientific Research

Shark Cartilage and Cancer Cells in the Laboratory

Research has shown that general shark cartilage treatment has no observable effect on cancer cells. 2 8 9 In other investigations, Neovastat®, a specific shark cartilage extract, has exhibited some antiangiogenic, apoptotic, and antimetastatic effects on tumors *in vitro*, in mice, and also in limited clinical trials.10 11 12

In one study, 0.6 grams cartilage/kilogram of body weight was administered to rats for 4.5 days. Angiogenesis was then induced in the abdomen of the animals with chemicals. The animals continued to receive the cartilage treatment for two weeks. The results showed a notable decrease in blood vessel formation in the rats that had been fed shark cartilage compared with those that were not.13 In another study, cancer cells were implanted into the corneas of rabbits. A pellet of highly purified shark cartilage was placed next to the cancer cells. After twenty days the tumors near the cartilage showed reduced blood vessel development with zones of complete inhibition around the pellets themselves.14

Shark Cartilage and Human Cancer

Because of the results of shark cartilage in animals, several studies were performed in the late 1990s to examine the effectiveness of shark cartilage in treating cancer patients. In one study, twenty prostate or breast cancer patients received 1 gram/kg/day of an oral shark cartilage powder for twenty weeks. Both survival times and quality of life were unchanged compared with a placebo control group.15 In another study, shark collagen was orally administered to sixty patients with different advanced cancers for six weeks. The study noted no complete or partial responses. The outcomes were similar to patients who had received only supportive care.16 Clinical trials with a shark cartilage extract, Neovastat® (AE-941), in patients with renal or lung cancer showed only limited or no benefit to patients.17 18

In summary, in model organisms, shark cartilage results in inhibited blood vessel growth. However, when shark cartilage extracts are administered to cancer patients, no conclusive results have been obtained to support the use of shark cartilage as a cancer treatment.

Four completed clinical trials showed no evidence of efficacy for Neovastat® in the treatment ofmultiple myeloma, plasma cell neoplasms, breast cancer, lung cancer, kidney cancer or colorectal cancer.19 20 21

Presently there are no clinical trials being performed with Neovastat®. To learn more,visit the NCI clinical trials database. Please visit our section on Finding Clinical Trials.

Further Reading

Read the National Cancer Institute's Physician Data Query (PDQ) summary on shark cartilage.

US Food and Drug Administration Approval

There is not enough evidence that Neovastat® is effective in the fight against cancer, and it has not been approved by the FDA for cancer treatment. 22

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.

- 1Gonzalez R.P., Leyva A., Moraes M.O. Shark cartilage as source of antiangiogenic compounds:from basic to clinical research. Biological Pharm Bull. (2001) 24:1097-1101. [PUBMED]
- 2 a b Joel B. Finkelstein. Sharks Do Get Cancer. Journal of the National Cancer Institute. Oxford: Nov 2, 2005. Vol. 97, Iss. 21; p. 1562. [PUBMED]
- 3Holt S: Shark cartilage and nutriceutical update. Altern Complement Ther 1: 414-16, 1995. [http://cancernet.nci.nih.gov/cancertopics/pdq/cam/cartilage/HealthProfessional/page3]
- 4Harshbarger JC. 1999 (pers. comm.). Registry of Tumors in Lower Animals. Department of Pathology, George Washington University Medical Center, Washington, D.C. [http://www.vin.com/Proceedings/Proceedings.plx?CID=IAAAM1999&Category=&PID=49514&O=Generic]
- 5D. J. Prieur, J. K. Fenstermacher, A. M. Guarino, J. Natl. Cancer Inst. 56. 1207 (1976); S. R. Wellings, Natl. Cancer Inst. Monogr. 31, (1969), p. 59/ J. C. Harshbarger, Activities Report of The Registry of Tumors In Lower Animals, 1965-1973 (Smithsonian Institution, Washington, D.C., 1974) [http://www.luogocomune.net/site/modules/mydownloads/library/acrobat/1185.pdf]
- 6M. L. Moss, Am. Zool. 17, 335 (1977) [http://www.luogocomune.net/site/modules/mydownloads/library/acrobat/1185.pdf]
- 7O'Reilly MS, et al. Endostatin: an endogenous inhibitor of angiogenesis and tumor growth. Cell. 24;88(2): 277-285, 1997. [PUBMED]
- 8Loprinzi C.L., et al. Evaluation of shark cartilage in patients with advanced cancer: a North Central Cancer Treatment Group trial. Cancer. 2005 Jul 1; 104(1):176-82. [PUBMED]
- 9Miller D.R., Anderson G.T., Stark J.J., Granick J.L. Richardson D. Phase I/II trial of safety and efficacy of shark cartilage in the treatment of advanced cancer, Journal Of clinical Oncology (1998) 16: 3649-3655 [PUBMED]
- 10Batist G, Patenaude F, Champagne P, Croteau D, Levinton C, Hariton C, Escudier B, Dupont E. "Neovastat (AE-941) in refractory renal cell carcinoma patients: report of a phase II trial with two dose levels." Ann Oncol (2002). (8): 1259-63.

[PUBMED]
- 11Castronovo V, Dimitriadou V, Savard P et al. Cartilage as a source of natural inhibitors of angiogenesis. In Teicher BA (eds): Antiangiogenic Agents in Cancer Therapy. Totowa, NJ: Humana Press 1999; 175-183.
- 12Dupont E, Falardeau P, Mousa SA et al. Antiangiogenic and antimetastatic properties of Neovsatst" (AE-941), an orally active extract derived from cartilage tissue. Clin Exp Metastasis (2002) 19: 145-153. [PUBMED]
- 13Davis, P., He, Y., Furneaux, R., Johnston, P., Rüger, B., & Slim, G (1997). Inhibition of angiogenesis by oral ingestion of powdered shark cartilage in a rat model. *Microvascular Research*, *54*(2), 178-82. (Original work published September 1997) [PUBMED]
- 14Lee, A., & Langer, R. (1983). Shark cartilage contains inhibitors of tumor angiogenesis. *Science (New York, N.y.)*, *221*(4616), 1185-7. (Original work published September 1983) [PUBMED]
- 15eitner SP, Rothkopf MM, Haverstick L, et al.: Two phase II studies of oral dry shark cartilage powder (SCP) with either metastatic breast or prostate cancer refractory to standard treatment. [Abstract] Proceedings of the American Society of Clinical Oncology 17: A-240, 1998.
- 16Miller, D., Anderson, G., Stark, J., Granick, J., & Richardson, D. (1998). Phase I/II trial of the safety and efficacy of shark cartilage in the treatment of advanced cancer. *Journal Of Clinical Oncology : Official Journal Of The American Society Of Clinical Oncology*, *16*(11), 3649-55. (Original work published November 1998) [PUBMED]
- 17Lu C, Lee JJ, Komaki R, et al.: A phase III study of AE-941 with induction chemotherapy (IC) and concomitant chemoradiotherapy (CRT) for stage III non- small cell lung cancer (NSCLC) (NCI T99-0046, RTOG 02-70, MDA 99-303). [Abstract] J Clin Oncol 25 (Suppl 18): A-7527, 391s, 2007.
- 18Escudier B, Choueiri TK, Oudard S, et al.: Prognostic factors of metastatic renal cell carcinoma after failure of immunotherapy: new paradigm from a large phase III trial with shark cartilage extract AE 941. J Urol 178 (5): 1901-5, 2007.
- 19Lu C, Lee JJ, Komaki R, Herbst RS, Feng L, Evans WK, Choy H, Desjardins P, Esparaz BT, Truong MT, Saxman S, Kelaghan J, Bleyer A, Fisch MJ. Chemoradiotherapy with or without AE-941 in stage III non-small cell lung cancer: a randomized phase III trial. J Natl Cancer Inst. 2010 Jun 16;102(12):859-65. Epub 2010 May 26. [PUBMED]
- 20Loprinzi CL, Levitt R, Barton DL, Sloan JA, Atherton PJ, Smith DJ, Dakhil SR, Moore DF Jr, Krook JE, Rowland KM Jr, Mazurczak MA, Berg AR, Kim GP; North Central Cancer Treatment Group. Evaluation of shark cartilage in patients with advanced cancer: a North Central Cancer Treatment Group trial. Cancer. 2005 Jul 1;104(1):176-82. [PUBMED]
- 21Escudier B, Choueiri TK, Oudard S, Szczylik C, NÃ©grier S, Ravaud A, Chevreau C, Venner P, Champagne P, Croteau D, Dupont E, Hariton C, Bukowski RM. Prognostic factors of metastatic renal cell carcinoma after failure of immunotherapy: new paradigm from a large phase III trial with shark cartilage extract AE 941. J Urol. 2007 Nov;178(5):1901-5. Epub 2007 Sep 17. [PUBMED]
- 22US Food and Drug Adminstration website. Accessed 6/20/2016. [http://www.fda.gov/] In fact, shark cartilage is on the FDA's list of fake cancer cures.