

The Longwood Herbal Task Force
(<http://www.mcp.edu/herbal/default.htm>) and
The Center for Holistic Pediatric Education and Research
(<http://www.childrenshospital.org/holistic/>)

Shark Cartilage

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Principal Proposed Use: Cancer

Other Proposed Uses: Psoriasis, arthritis, diabetic retinopathy

Overview

Shark cartilage is used as an alternative cancer treatment and for relief of symptoms of arthritis, diabetic retinopathy and psoriasis. Preliminary case reports and phase I and II trials offer some support for its use in treating adults suffering from solid tumors, but phase III trials have not been completed. There are no controlled trials evaluating its effectiveness in treating any condition. Reported side effects include nausea, vomiting, constipation, hypotension, hyperglycemia, altered mental status, generalized weakness and decreased motor strength, sensation and performance. Shark cartilage is contraindicated during pregnancy, lactation, childhood and in any condition in which impaired angiogenesis may be harmful.

Historical and Popular Uses

Shark cartilage has been used for thousands of years in China in a health product called shark fin soup.

In the early 1970s, researchers at the Harvard Medical School reported that tumor growth and metastatic dispersion are angiogenic-dependent processes¹, and that cartilage may inhibit angiogenesis². Shark cartilage is now used both as an angiogenesis inhibitor in the treatment of cancer and as a joint lubricant in arthritis³. It is also occasionally used to treat psoriasis and diabetic retinopathy⁴. In 1995, more than \$30 million was spent on shark cartilage products⁵.

Close to 50,000 Americans use shark cartilage products each year; most users are well-educated and often suffer from advanced disease^{6,7}.

Shark cartilage is obtained from freshly caught spiny dogfish sharks and hammerhead sharks in the Pacific Ocean⁸. The cartilage is cleaned, shredded, dried, pulverized and sterilized. Powdered shark cartilage can be mixed with water or fruit juice to be taken orally or it can be administered rectally as a retention enema. Some manufacturers mix the supplement with bovine cartilage, which is less expensive and is also claimed to be an effective cancer treatment⁹. Other manufacturers may provide products containing only a small amount of shark cartilage extracts and a large amount of fillers to reduce the cost^{5,10}.

Biochemistry

Shark Cartilage: Potentially Active Chemical Constituents

- Proteins: troponin-I, tetranectin-type protein, collagenases, cartilage-derived inhibitor (CDI), tissue inhibitors of metalloproteinases (TIMPs)
- Glycoproteins: shyrnastatin-1 and -2, galactosamine, glucosamine
- Glycosaminoglycans: chondroitin sulfate-D, chondroitin-6-sulfate, keratan sulfate

Troponin I appears to interfere with the growth of endothelial cells and to inhibit angiogenesis¹⁶. *Tetranectin* is a human protein important in connective tissue structure; levels are often reduced in different types of cancer. Shark cartilage contains a tetranectin-type protein (a C-type lectin) which is 45% identical to human tetranectin¹². Shark cartilage's *collagenases* and a protein called *cartilage derived inhibitor (CDI)* block endothelial cell migration and proliferation^{17,18}. Also present in shark cartilage are *tissue inhibitors of metalloproteinases*, or *TIMPs*^{19,4,18}. They appear to block the action of metalloproteinases, which are enzymes secreted by tumor cells that help them invade surrounding tissues²⁰.

Glycoproteins *shyrnastatin-1* and *-2* were isolated from the hammerhead shark *Sphyrna lewini*; they were reported to have strong antiangiogenic activity and to inhibit tumor neovascularization¹¹.

Glycosaminoglycans regulate chondrocyte metabolism and form a matrix to hold together protein components of skin and connective tissue, thus inhibiting enzymatic degradation of both proteoglycans and collagen²². *Chondroitin sulfate*, isolated from shark cartilage in 1961²¹, appears to improve osteoarthritis symptoms²³; most chondroitin sulfate is from other sources.

Experimental Studies

Shark Cartilage: Potential Clinical Benefits

1. Cardiovascular: none
2. Pulmonary: none
3. Renal and electrolyte balance: none
4. Gastrointestinal/hepatic: none
5. Neuro-psychiatric: none
6. Endocrine: none
7. Hematologic: none
8. Rheumatologic: Arthritis
9. Reproductive: none
10. Immune modulation: Anti-inflammatory
11. Antimicrobial: none
12. Antineoplastic: Antiangiogenesis for solid tumors
13. Antioxidant: none
14. Skin and mucus membranes: Psoriasis
15. Other/miscellaneous: Diabetic retinopathy

1. **Cardiovascular:** none
2. **Pulmonary:** none
3. **Renal and electrolyte balance:** none
4. **Gastrointestinal/hepatic:** none
5. **Neuro-psychiatric:** none
6. **Endocrine:** none
7. **Hematologic:** none
8. **Rheumatologic:** Arthritis: According to anecdotal reports, shark cartilage, which contains chondroitin sulfate, reduces symptoms of arthritis. There are *in vitro*, animal and human studies evaluating the effectiveness of glucosamine and chondroitin sulfate as treatments for osteoarthritis, but none specifically evaluating products derived from shark cartilage.
9. **Reproductive:** none

10. Immune modulation: Anti-inflammatory

- i. *In vitro data:* none
- ii. *Animal data:* A water-soluble fraction of shark cartilage had weak anti-inflammatory and significant analgesic activity in Wistar rats pre-treated with acetic acid and formalin, compounds known to induce pain and inflammation²⁴.
- iii. *Human data:* none

11. Antimicrobial: none

12. Antineoplastic: Antiangiogenesis for solid tumors

- i. *In vitro data:* Shark cartilage constituents protected cells pre-treated by hydrogen peroxide and carcinogens such as 2-aminofluorene and sodium azide against DNA damage and mutagenesis²⁵. Shark cartilage extracts inhibited cell migration, produced a dose-dependent decline in thymidine incorporation, inhibited angiogenesis, and blocked collagenase-induced collagenolysis in human umbilical vein endothelial cell cultures^{17,26}.
- ii. *Animal data:* Seven animal studies (three in rabbits and four in mice) evaluated the antiangiogenic effects of shark cartilage; inhibition of tumor growth (carcinoma, sarcoma and melanoma) was observed in four of these trials^{2,17,27,28,29,30}.
- iii. *Human data:* Telephone interviews with 21 adult oncology patients who used 15 – 120 grams of shark cartilage daily revealed that none used shark cartilage as monotherapy. Seventeen of the 21 reported improvements in quality of life. Six reportedly became tumor free, six experienced reductions in tumor size, and seven patients with prostate cancer reported reductions in prostate specific antigen (PSA) levels³¹.

A nine-year-old girl with a brain tumor who used shark cartilage in place of conventional therapy died secondary to her tumor³².

Several open label (non-blinded, non-controlled) trials evaluated shark cartilage treatments for adults with advanced (stage III and IV) cancers who had not responded to other treatments and had life expectancies less than six months^{33,34}. Dosages of shark cartilage ranged from 30 grams per day to 1 gram/kg/day divided into two or three oral or rectal doses; no therapies were given concurrently except in one study which offered psychosocial support and nutritional therapies (multivitamins and minerals). Six out of

eight patients in one study had an 80% or greater reduction in tumor size within 11 weeks of treatment; no significant toxicities were reported³³. In an unpublished study of 29 patients who received shark cartilage rectally for 6 to 16 weeks, 55% noted symptomatic improvements such as weight gain³⁵. In another study, of 60 patients enrolled, 13 were lost to follow-up within 12 weeks, five withdrew because of gastrointestinal symptoms, five died, 27 had progressive disease, ten had stable disease for 12 or more weeks, and none had a partial or complete remission; side effects were primarily gastrointestinal (nausea, vomiting, constipation, diarrhea), but also included hypotension, hypoglycemia, altered mental status, and weakness³⁴.

Preliminary news reports have been released from two ongoing studies of shark cartilage therapy for adults with solid tumors. In one study of 70 cancer patients (tumor type not stated) treated with shark cartilage, ten reported an improved quality of life; of these, four had a 50% or greater reduction in tumor mass; doses and co-therapies were not reported³⁶. Among four patients with stage IV cancer unresponsive to other therapies who were enrolled in trial of shark cartilage as monotherapy, two had no response, one remained stable and one had a 25% reduction in metastases; side effects were not reported³⁷.

No phase III trials have been completed evaluating shark cartilage, but the National Cancer Institute is initiating phase III trials in 1999³⁸. There has been no research of shark cartilage's use to prevent cancer.

13. Antioxidant: none

14. Skin and mucus membranes: Psoriasis

- i. *In vitro data:* none
- ii. *Animal data:* none
- iii. *Human data:* A phase II open-label trial evaluated the effects of shark cartilage in 49 psoriatic patients. Twenty five patients dropped out, primarily due to unpleasant gastrointestinal side effects. Shark cartilage reduced psoriatic plaques in a dose-dependent manner; patients taking the largest dose tested (240-mL/day of the shark cartilage preparation AE-941) had a mean psoriasis area and severity index (PASI) score reduction of 26%³⁹.

15. **Other/miscellaneous:** Diabetic retinopathy. The use of shark cartilage for diabetic retinopathy is based on anecdotal reports and the belief that the anti-angiogenic properties of the supplement can be beneficial in angiogenic disease states such as diabetic retinopathy and neovascular glaucoma. However, there have been no animal or human studies evaluating these claims.

Toxicity and Contraindications

All natural products carry the potential for contamination with other substances, fillers, other active ingredients, heavy metals and pharmaceuticals.

Allergic reactions can occur to any natural product in sensitive persons.

Allergic reactions have been reported.

Potentially toxic compounds in shark cartilage: None known; may be contaminated with bovine cartilage.

Acute toxicity: Reported side effects include nausea, vomiting, constipation, hepatitis, hypotension, hyperglycemia, altered mental status, generalized weakness and decreased motor strength, sensation and performance⁴⁰.

Chronic toxicity: Unknown

Limitations during other illnesses or in patients with specific organ dysfunction: Because of shark cartilage's antiangiogenic effects, it should not be used by patients who have vascular insufficiency or are undergoing surgery.

Interactions with other herbs or pharmaceuticals: Unknown

Safety during pregnancy, lactation and/or childhood: Because of shark cartilage's antiangiogenic effects, it should not be used during pregnancy, lactation or childhood.

Typical dosages

Provision of dosage information does not constitute a recommendation or endorsement, but rather indicates the range of doses commonly used in practice.

Doses may vary according to the type and severity of the condition treated and individual patient conditions.

For adults with solid tumors: 1 - 2.5 g/kg of body weight per day divided into two or three doses.

If taken orally, the shark cartilage powder is mixed with 4-6 ounces of water or juice (orange, apple, grape or tomato) and taken one hour before meals.

For psoriasis: 0.4 - 0.5 g/kg of body weight for four weeks, then 0.2 – 0.3 g/kg for another four weeks.

For diabetic retinopathy: 0.4 - 0.5 g/kg of body weight daily for four weeks, then 0.132 g/kg daily for maintenance.

Pediatric dosages: Shark cartilage is contraindicated for pediatric use.

See Also:

Shark Cartilage Clinician Information Summary:

<http://www.mcp.edu/herbal/sharkcartilage/sharkcartilage.cis.pdf>

Shark Cartilage Patient Fact Sheet:

<http://www.mcp.edu/herbal/sharkcartilage/sharkcartilage.ph.pdf>

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