

## **Chondroitin Sulfate**

### **History**

Chondroitin sulfate is derived from bovine, shark or avian cartilage.

### **Most studied uses**

Osteoarthritis

### **Other common uses**

Atherosclerosis, iron deficiency, dry eyes, cystitis.

### **Summary of the evidence**

- There is reasonably good evidence that chondroitin reduces the symptoms of osteoarthritis and possibly slows the long-term progression of the disease as well.
- Chondroitin is well tolerated with minimal adverse effects or drug interactions.
- Although often used in combination with glucosamine, there no data to asses whether their effects are additive or how they compare.

### **Pharmacology**

- Chondroitin belongs to a class of very large molecules called glycosaminoglycans which are made up of glucuronic acid and galactosamine.
- Chondroitin is a very large molecule (16,900 Daltons) so it is poorly absorbed. Oral bioavailability is less than 20%.

### **Mechanism of action**

- In vitro models show that chondroitin stimulates proteoglycan production and collagen and hyaluronic synthesis. It thus appears to act as a ‘building block’ for the synthesis of cartilage, thereby slowing the progressive degradation which occurs in osteoarthritis.
- Chondroitin also seems to inhibit the inflammatory enzyme leukocyte elastase, an effect which may provide some analgesia and contribute to the slowing of cartilage degradation.

## **Clinical studies**

- A Cochrane meta-analysis (Leeb et al) found 7 good quality RCTs. Pain scores showed statistically significant differences in favor of chondroitin. All 7 trials reported a reduction in the use of NSAID's but no patients were able to stop them completely. This analysis is hampered by heterogeneity among patients in the different trials and publication bias (only published studies were used).
- A second meta-analysis (McAlindon et al) included 9 RCT's of chondroitin (799 total patients). Both published and unpublished studies were included. The overall effect size was significant in favor of chondroitin (p=.05).
- A RCT of a combination of chondroitin (1200mg/d), glucosamine (1500mg/d), and manganese ascorbate (228mg/d) [Cosamine DS] showed significant improvement in subjective measures but not in a reduction of analgesic use or physical examination scores. (Leffler et al)

## **Adverse effects**

- Gastrointestinal effects including epigastric pain, diarrhea and constipation have been reported but are similar to placebo.

## **Contraindications/cautions**

- Caution for use in patients with prostate cancer patients or elevated levels of prostate specific antigen (PSA) as one study found that increased endogenous chondroitin levels were associated with poor outcomes and increased tumor progression.

## **Important drug/herb interactions**

- No interactions with drugs have been reported.

## **Formulation and dosage**

- Most studies have tested 400 mg tid.
- In a few studies chondroitin has also been as a single daily dose of 1000-1200mg.
- Patients should be warned that symptom relief may take up to 8 weeks to become apparent, which is longer than patients may be used to with NSAID's.

### **Key Chondroitin References**

1. Leeb BF, Schweitzer H, Montag K, Smolen JS. A meta-analysis of chondroitin sulfate in the treatment of osteoarthritis(*the Cochrane library*).*J Rheumatol* 2000;27:205-211.
2. McAlindon TE, LaValley MP, Gulin JP, Felson DT. Glucosamine and chondroitin for treatment of osteoarthritis: a systematic quality assessment and meta-analysis. *JAMA* 2000;283:1469-1475.
3. Leffler CT, Phillipi AF, Leffler SG et al. Glucosamine, chondroitin and manganese ascorbate for degenerative joint disease of the knee or low back: a randomized, double-blind, placebo controlled pilot study. *Military Med* 1998;164:85-91.

### **For Additional Information**

1. Natural Medicines Comprehensive Database. Available through UW Healthlinks.
2. About Herbs. <http://www.fammed.washington.edu/predoctoral/CAM/sites.html>.
3. Herbmed.org for more general background.
4. For information about the quality of specific brands, check Consumerlabs.com.

