

## Capsaicin for Nasal Congestion

Although capsicum has been harvested mainly as a spice, its use has become more diverse throughout the years. One of its first documented uses was in the 1400s by a physician who accompanied Christopher Columbus to the West Indies.<sup>1</sup> Capsicum is a pepper that has numerous uses that include relief of diarrhea, cramps, hyperflatulence, seasickness, malarial fevers and reduction in blood clotting tendencies, just to name a few indications.<sup>2</sup> Chemically, capsicum contains ~1.5% of the irritant oleoresin and ~0.02% capsaicin (8-methyl-n-vanillyl-6-nomamide) which is a very pungent phenolic compound responsible for the analgesic properties of the pepper.<sup>1</sup> When used topically, capsaicin causes the release of substance P, a neurotransmitter and chemotactic agent responsible for the sensation of pain. Capsaicin is also said to stimulate unmyelinated slow C-fibers in the central nervous system which are known to induce cough, dyspnea and nasal congestion.<sup>1,6</sup>

The mechanism of action that capsaicin exudes on various aspects of the body is somewhat well understood. This knowledge has allowed researchers to do extensive studies on possible therapeutic uses. Of the possibilities, treatment for allergy and hyperreactivity have been somewhat more promising endeavors because these ailments are now so common they constitute “a major health problem.”<sup>3</sup> Because allergies fall into various categories depending on severity, duration and symptoms, the use of capsaicin for one allergic condition may be reasonably effective while another allergic condition may not respond to the treatment at all. Of the vast array of prevalent allergic conditions, rhinitis is one of the more researched that has been challenged with capsaicin treatment.

Rhinitis presents in patients a number of ways that can be classed as either infectious, chronic or allergic.<sup>4</sup> Infectious rhinitis is the medical terminology for “the common cold.”<sup>4</sup>

Causes of infectious rhinitis include major offenders such as adenoviruses, echoviruses or rhinoviruses which can sometimes be followed by secondary bacterial infections which may enhance the inflammatory response. Chronic rhinitis is the second type of rhinitis that can be either microbial or allergic in origin. One documented cause of chronic rhinitis is a deviated septum. This may lead to impaired nasal drainage which may result in microbial invasion. Allergic rhinitis (hay fever), the third type of rhinitis, is most commonly induced by sensitivity reactions to plant pollens, fungi, animal allergens, dust mites, etc.<sup>4</sup> All three types of rhinitis are accompanied by mucosal edema, leukocytic infiltration and nasal congestion. In three separate clinical trials, researchers tested the efficacy of capsaicin therapy with rhinitis.

In a study done by the Department of Oto-Rhino-Laryngology in Stockholm, Sweden, nine patients who were suffering from allergic rhinitis were chosen at random from the Department of Allergology at the Karolinska Hospital. The purpose of this clinical trial was to “study the involvement of capsaicin-sensitive C-fibre afferents in the nasal allergic reaction . . .”<sup>3</sup> All the patients had a history of sneezing, rhinorrhea (runny nose) and/or nasal congestion during the burch pollen season. The allergen (burch pollen) was delivered freeze-dried and reconstituted before trial with human serum albumin diluent. The allergens were sprayed intranasally, unilaterally and the patients were evaluated at 30 seconds, 2, 10, 15, 30, 60 and 90 minutes, and 24 hours after the challenge. Patients were then asked to rank their level of discomfort for each nostril using a visual analogue scale (VAS) ranging from 0 (no symptoms) to 100 mm (unbearable). Saline was then sprayed into the nostril and allowed to drain down the throat. The fluid was then aspirated using a syringe and analyzed (cell count) using light microscopy. Five patients were then treated intranasally with 30  $\mu$ M capsaicin and

the remaining four were treated with placebo. Each patient received a cotton strip soaked in the respective medium and it was allowed to sit for 15 minutes (the treatment was repeated over the next two days). After being challenged every week for two months according to the protocol above, patients treated with the capsaicin reported a significant decrease in symptom score (VAS) on the challenged side. Capsaicin pretreatment appears to have a long-lasting (up to six months) reduction of symptoms in patients with nasal hyperreactivity.<sup>3</sup>

In a double-blinded placebo-controlled study, 35 patients who suffered from non-allergic non-infectious perennial rhinitis were admitted for testing in capsaicin-induced rhinitic relief. Patients were chosen based on the presence of clear nasal discharge, sneezing and nasal blockage persisting for at least 1hr/day for at least 5 days throughout the course of 14 days (mucus production or coughing were used as indicators for upper airway infections and would lead to exclusion of the patient from the trial). Twenty-five of the initial 35 patients chosen for the study actually qualified. Before beginning the capsaicin treatment, each patient was anesthetized using Xylocaine spray. This anesthetizing procedure was described by all subjects as “most unpleasant.”<sup>5</sup> Fourteen of the 25 patients were given 0.15 mg capsaicin intranasally once every second or third day for a total of seven treatments and 11 were treated with placebo (same regimen as active drug). After three capsaicin treatments, one of the 14 (capsaicin) patients couldn't continue due to influenza with fever. Basal biopsies were taken before and 2 weeks, 3 months and 9 months after the treatment period. Patients who were challenged with capsaicin reported a long-lasting relief of symptoms that included rhinorrhea, congestion, sneezing and coughing (this relief was reported to have lasted for up to 9 months after treatment).<sup>5</sup>

In another double-blind, randomized, cross-over study approved by the Institutional Review Board of the Johns Hopkins Bayview Medical Center, ten volunteers (six men and four women, ages 28-68) who presented with active allergic rhinitis participated in the capsaicin nasal spray challenge. All the subjects in this study had sensitivity to at least two aeroallergens (which was confirmed using skin-allergen testing). Patients involved in the study abstained from the use of antihistamines or  $\alpha$ -adrenergic agonists for at least 1 week and steroids or cromolyn for at least 1 month prior to the study. Three doses of capsaicin—1  $\mu$ g, 10  $\mu$ g and 100  $\mu$ g—were administered intranasally in separate doses once a week as a spray of 20  $\mu$ mol/L, 200  $\mu$ mol/L and 2 mmol/L, respectively. Each solution was dissolved in 5% EtOH and 5% Tween-80 (Sigma Chemical Co.) to be delivered into both nostrils using a metered nasal spray delivering 75  $\mu$ L per actuation. Two nasal lavages were then collected using 5ml then 10 mls of lactated Ringer's solution (warmed to 37°C). The solution was sprayed into both nostrils with a pipette while the head was extended. The solution was then expelled into a plastic collection basin after 10 seconds. The individual samples were then stored on ice and centrifuged at 2500g for 15 minutes at 4°C. The lavages were then stored in aliquots at -20°C for later assays. The samples were combined and resuspended in 1 ml of lactated Ringer's solution. A 10  $\mu$ L aliquot of the cell suspension was then placed in a hemocytometer to perform a total leukocyte cell count. Based on the results, capsaicin at a 1  $\mu$ g dose does not produce any significant increase in leukocyte counts. However, the 10  $\mu$ g dose produced increased leukocyte numbers at two measured time points while the 100  $\mu$ g dose produced increased leukocyte numbers at all three time points measured. Increased vascular permeability, as a result of the greater influx of leukocytes and other agents, appears to be the nasal inflammatory response to neuronal stimulation that is unique to patients

suffering from active allergic rhinitis.<sup>6</sup> From this study, it can be seen that capsaicin-induced leukocyte influx in active allergic rhinitis has a marked influence dependent on dose.<sup>6</sup>

According to the studies conducted, the effects of capsaicin on nasal congestion appears to be dependant on pathology and dose. In non-allergic non-infectious perennial rhinitis and allergic rhinitis, there appeared to be significant relief of symptoms due to the introduction of capsaicin. The doses in both clinical cases were somewhat low relative to the active allergic rhinitis case and relief of symptoms seemed to be quit evident. In the case study involving active allergic rhinitis, there appeared to be an acute increase of symptoms followed by a long-term decrease in symptoms. The larger dose of capsaicin proved to account for the increase in leukocyte infiltration, which led to the increased initial allergic response.

The manner in which the studies were put together were ideal for the question at hand; Is capsaicin useful in relief of allergy symptoms (particularly nasal congestion)? All studies used double-blinded, randomized testing and the subjects used in the studies had diversity of age, gender, background, etc. with allergic affliction remaining the internal standard. This method of utilizing diverse subjects gave researchers a better idea of the effectiveness of treatment. Although the results of the studies were somewhat significant, the clinical significance is still lacking. In all cases, the pre-capsaicin anesthetic treatment and the capsaicin treatment itself proved to be unpleasant for the patients. Also, the burning sensation and the route of administration associated with treatment were very painful and uncomfortable for the patient making this treatment “unlikely to be of clinical use.”<sup>3</sup>

**References:**

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