INFLAMATION

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Inflammation is a necessary part of the body's healing process, but if left unresolved, problems can occur. The August issue of *Swimming World Magazine* focuses on the causes, consequences and cures of inflammation. Following is the complete, unabridged article:

Much has been written over the years, especially with the change from prescription to over-the-counter of various non-steroidal anti-inflammatory drugs (NSAIDs for short), about inflammation and how to keep it in check. Let me first state that, in general, inflammation is not a good thing...better not to have it happening at all if possible; but on occasion, it is a necessary process that the body endures to help it return to homeostasis (original biologic condition of adequacy) after some bad physiological things happen.

Many of the body's healing processes have inflammation as a component of the cascade of events to bring a condition to resolution; and this is as it should be. We can find our way into trouble, though, if the inflammation is not resolved, or if it becomes acute to where the body needs to marshal much of its inner natural energies to get on top of the situation. If inflammation is not resolved in a timely fashion and becomes chronic, then other physiologic processes appear--none of which is good for athletic performance and general quality of life.

To that end, it is wise to seek proper medical intervention, be it medication, physical rehabilitation, a healing diet, a more healthful lifestyle or even simple rest. This article hopefully will make the athlete aware, no matter the age, of the "three C's" of human biology: the causes, the consequences and the cures.

DESCRIPTION OF INFLAMMATION

Using basic concepts, inflammation is a gathering of cellular elements (white blood cells, histamine and other chemical factors) that the body releases into circulation to the affected area involved either with trauma, infection, overuse or toxic exposure. In an acute situation, the elements released cause a whole cascade of events to occur that nature provides to, at first, try and isolate the trouble to as small an area as possible, and then to immobilize the area to hopefully prevent further spread. An often-seen consequence of this is "The Three Musketeers" of inflammation...from the Latin: calor (heat), dolor (pain) and rubror (redness). Swelling is a common addition to the above trio...all done with nature's best intent to heal what is wrong. But this intent is often not compatible with the athletic goal of "swifter, higher, stronger."

If the inflammation is allowed to become chronic, a situation can emerge where the body sort of allows a "Mexican standoff" to occur. Here

the main elements of the above cascade of inflammation subside, but not totally disappear. The bad news here, even though the body may feel somewhat better, is that since total resolution has NOT occurred, tissue damage is allowed to continue, and a festering, if you will, begins to invade the affected site. What is even more disturbing is the possibility of altered tissue integrity...the loss of functioning capacity and even regression to a state of damaged DNA which can lead to pre-malignant or malignant states.

CAUSES AND CONSEQUENCES OF INFLAMMATION

Causative elements can come from any or all of the following: infective micro-organisms, sudden and intense trauma, unhealthy lifestyle or diet, chronic overuse, or toxic exposure. With regard to microorganisms, Mother Nature has provided proper compartmentalization for resident bacteria in the body. If bacteria like E. coli, which usually are harmless in their intended place of origin (the lower gut), find their way into an area not intended for their residence (upper gut) through either contaminated food or water where swimming is allowed, those exposed can develop severe gastrointestinal inflammation...gastritis.

We can also have the situation where several types of bacteria, which normally reside ON the skin, can produce serious inflammatory reactions if allowed to penetrate into deeper tissue areas due to trauma--some to the extent that the skin can actually be eaten away, and a dangerous generalized septicemia (systemic bacterial blood poisoning) could develop that can kill.

A somewhat "high-profile" bacteria has come to the public's awareness of late: Helicobacter Pylori, better known as H. pylori. This is not a normal resident of the stomach, but when found there, it has shown a correlation of almost 100 percent in those with gastric ulcers. People can have H. pylori and not have an ulcer, but those with ulcers from otherwise unexplained causes will almost always test positive for this stomach invader. What is even more distressing is the fact that the chronic inflammatory condition the bacteria produces in the gut tissue could lead to a strong association between H. pylori's presence and stomach cancer.

Infection with H. pylori is increasing in numbers throughout the population to where we see the older one gets, the more likely he/she will test positive. Signs or symptoms to watch for are: sudden chronic stomach upset, acid reflux (which can cause its own inflammatory response in the esophagus, or food channel), intolerance for foods that never gave problems before, and surprisingly, a constant low reading of HDLs (high-density lipoproteins) even with devout aerobic training.

It seems the inflammation the bacteria causes interferes with the body's ability to metabolize fats properly. In fact, a few studies have shown that getting rid of H. pylori in the gut allows for an almost 25 percent rise in HDLs (the good cholesterol). A logical action if an athlete constantly comes

up short on HDLs would be to request a blood test for H. Pylori even if no symptoms out of the ordinary appear.

Science is not sure how infection is spread with H. pylori, but we see several avenues emanating from the gastrointestinal area: dentists are quite susceptible due to constant proximity to their patients' mouths. The bacteria can be found in poorly treated pools and can spread to those who, unfortunately, swim through a contaminated area. Food handlers can also be focal areas of spread.

Intense trauma that effects bony structures can most definitely produce inflammatory reactions. Bone is a constantly-changing structure, gaining and losing calcium, but it is a relatively-slow healing organ. Unlike most soft tissue trauma (other than vital organs), bone pain can last for months with severe trauma, and inflammation can find a "home" in relatively quick time.

Any involvement with bone leaves the potential for prolonged and serious consequences. In fact, it is almost a given that the body will produce an arthritic condition that causes calcium to be deposited at the site of injury. Even sub-acute constant trauma will eventually produce an osteoarthritic condition that makes the victim pay the price with reduced mobility and range-of-motion--to say nothing of the constant discomfort.

And age is not a specific factor of the condition. High school athletes, for example, may think they've healed from a physically traumatic experience (it's good to be young). The immediate intense discomfort has dissipated, but eventually they pay the price.

There is one soft tissue involvement, however, that can have very severe consequences, and it doesn't usually come from trauma, per se. When the coronary arteries become inflamed, the body's response is to send, by way of the circulation, the elements listed above, plus it increases the chances for calcium to be deposited in-situ (at the site). The calcium actually produces an irregular surface on the inside lining (intima) of the arteries that then allow for elevated circulating cholesterol and other fats to cling, harden and finally occlude. Thus, it should be the goal of those seeking a healthy lifestyle to try and keep the coronary arteries from becoming inflamed, so this potentially deadly cascade of events is prevented or at least diminished.

There is now an easy-to-obtain blood marker (test) that can be used with some degree of medical certainty to spot inflammation in the body. In fact, it can show itself with most types of systemic inflammation; but if there are no other inflammatory processes going on, and this marker is elevated, then prudent medical analysis would call attention to the possibility of coronary artery inflammation. This blood marker is called C-Reactive Protein (CRP). Though it was first discovered in 1930, CRP has only recently been confirmed in an important association for potential coronary artery risk.

Many physicians are now using the CRP enzyme to establish heart-attack potential. Almost half the heart-attack and stroke victims each year in the United States have essentially normal cholesterol levels. Even a moderately elevated serum cholesterol may not be considered as potentially dangerous as in the past if the CRP is below a certain threshold. Low risk: CRP less than 1 milligram per liter (mg/L); moderate risk: CRP 1 to 3 mg/L; high risk: CRP above 3mg/L.

Unfortunately, in our modern multi-task society, many seem to be deprived of the quality of life needed to lead a healthy lifestyle. The main deprivation from this way-of-life is adequate rest, especially quality sleep. There have been a few studies of late that have shown the C-Reactive Protein to rise to potentially heart-damaging levels in a sleep-deprived state.

Someone who subsists on 4 to 5 hours of sleep when 7 to 8 are needed over an extended period of time can develop an elevated CRP. This probably results from increased cortisol (the anti-stress hormone) being spilled into the circulation. Add to this dietary practices that allow for excess cholesterol and triglycerides to enter the circulation, and you create the potential for coronary heart disease (CHD).

Just about every athlete who trains intensely to get to a higher level becomes at risk for overuse injury. Each sport has its vulnerable body parts. With swimmers, it's mostly the articular joints of the shoulders, knees and neck (in that order) that present targets of discomfort and inflammation.

Swimmer's shoulder is the most common injury for aquatic athletes, and it involves the most important areas of the body for moving through water. Performing thousands of repetitive motions day-in and day-out will tax most anatomical areas to their breaking point. Once the shoulders become over-stressed, the elements of inflammation emerge...all wreaking havoc in a small enclosed space that was never really designed to perform these intense overhead actions repeatedly. The shoulder girdle is not even a well-developed stable ball-and-socket joint. The elements that compose the inner workings of the shoulder have little space in which to navigate comfortably through the optimum range-of-motion (ROM) needed for correct form and fast swimming.

If development of improper technique ensues whether from fatigue, ignorance of proper mechanics or poor coaching, and it is not corrected (and kept from returning), the athlete is at risk for developing a full-blown inflammatory condition. Constant rubbing and continued irritation, but lacking appropriate rest and recovery...all contribute to the development of the items listed above to produce what could wind up as an aquatic-terminating condition.

The knees in breaststrokers are the most vulnerable, with the shoulders a secondary concern. The knees for obvious reasons: the requirements of the breaststroke kick, if done optimally, place much pressurized torque on the medial (inside) aspect of the knees. Ideal form

requires "high heels"...where the ankles must reach all the way back and the heels approach the butt with each kick to move as much water as possible.

Any inflammation that develops in the knee could lead to the condition of crepitus...where "sounds" are heard upon movement; eventually the "sounds" are joined by pain, weakness and reduced range-of-motion...all due to arthritic (calcium) deposits. This can happen at any age, but is usually seen after several years competing in breaststroke.

The shoulders in breaststrokers (flyers, too) can develop problems due to repetitive open turns at the walls. If done correctly, one arm sustains more compression against the shoulder girdle than the other...usually the top arm on an open turn. If one turns from right to left, for example, after the touch, it is usually the right arm (the last to leave the wall) that deals with compressing the humerus (upper arm bone) into the inner workings of the shoulder structures (mostly the supraspinatus...one of the rotator cuff muscles).

Toxic exposure as a cause of inflammation should not be any more common to aquatic athletes than to athletes in other sports, but it is. Any athlete can experience toxins released with certain contaminating bacteria in food, and everyone must be vigilant to prevent this potentially debilitating condition. But the aquatic athlete, by nature of his sport, is exposed to either chemically-treated pools and/or non-treated open water.

Inflammatory reactions to the skin and mucous membranes (eyes and respiratory tract) often occur in poorly maintained aquatic venues...mostly with too little active chlorine and too much chlorine-breakdown metabolites. The body biochemically can handle an acidic environment (pH 1.0-6.8) better than it can handle a basic one (pH 7.5-14).

When one smells chlorine, and the nose and eyes become irritated, it is usually from a highly basic condition. Asthma in swimmers has become more prevalent. Whether it be cause-and-effect from training in a contaminated environment or the athlete bringing the condition to the sport, inflammation of the respiratory tract is the resultant.

TREATING INFLAMMATION

Some treatments are obvious and straight-forward: anti-infectives for infections; anti-inflammatory medication for simple inflammation; removal from toxic exposure or treatment of same with medication; simple lessening of movement or complete rest with overuse symptoms.

For the most part, we would be fortunate, indeed, if the above procedures work. To varying degrees they do, but in-depth true resolution of the inflammation syndrome at times requires some medical sophistication and biological logic.

Sometimes exotic multiple antibiotics and ancillary medications are needed with complex dosing regimens to eliminate resistant strains of infecting organisms. We see this with the above-mentioned gut-invader, H.

pylori. Leaving this bacteria to fester in the gut is just asking for trouble. It is not a normal gastrointestinal resident...eliminate it!

Since we are after-the-fact in treating trauma, isolating the damaged tissue and treating it vigorously is the most logical approach. Down time for an athlete is usually all negative.

As mentioned in the opening paragraph, there are now several potent over-the-counter (OTC) non-steroidal anti-inflammatory drugs (NSAIDs) that can bring about inflammatory resolution in a receptive patient. There are also new prescription medications that claim to reduce side effects while performing their seemingly miraculous work. None are without long-term risks.

But there are several research studies going on presently in which the anti-inflammatory substances come from natural sources. Phytochemicals (chemicals from a plant source) have presented an exciting avenue of research with their anti-oxidant and anti-inflammatory activity. Plants such as milk thisle, tumeric, garlic, onion and ginko biloba have all shown to possess substances that lessen inflammation when ingested.

A rather well-known natural substance now used by several Olympic teams is the enzyme, bromelain. Bromelain aids in muscular recovery after intense training, and it also aids digestion. Most tropical fruits possess this, with pineapples having the most. The enzyme is now available in capsule form with concentrations much higher than can be ingested consuming reasonable amounts of the natural source.

Another natural anti-inflammatory that is showing great promise is the omega-class of fats. Two forms of the free-fatty acid are seen: omega-6 and omega-3. The former comes from plant sources such as corn, safflower and sunflower oils. The latter is derived from certain fatty fish: salmon, tuna, sardines, rainbow trout and sea bass; as well as plant sources: flaxseed oil, walnuts and canola oil.

Research has shown that it is the ratio of omega-6’s to omega-3’s that has the effect of either producing inflammation or reducing it. Too much omega-6, and inflammation is allowed to occur. With a dietary ratio of omega-6 to omega-3 in a 2:1 up to a 4:1 intake, the inflammatory response can be lessened. The same research is also combining these natural anti-inflammatory substances with NSAIDs to see if lower doses with less side effects can produce the same benefits over an extended period of time.

Those swimmers constantly exposed to irritating chemicals in their pool environment can develop definite breathing difficulties. Chronic exposure can lead to chronic inflammation of the respiratory tract. Anti-inflammatory inhalers and/or oral medication, bronchiole dilators, and other related medications can only treat the symptoms.

Once asthma has taken hold, it usually becomes a permanent condition with variances in severity day-to-day. Some days...pretty good; some days, even medication seems not to help much. Much better not to

develop the condition in the first place. Therefore, it is incumbent upon all places that have certified pool operators (CPOs) responsible for healthy pool conditions that the aquatic environment is kept in a swimmer-friendly condition at all times.

Some things in life can and should be prevented. Most inflammatory reactions and conditions fall into this category. When inflammation does occur due to circumstances beyond our control, it is best treated heroically and with all good intent to resolve it; letting inflammation linger, or taking a cavalier attitude about its systemic resolution could place the sufferer in a precarious position, to say the least.

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