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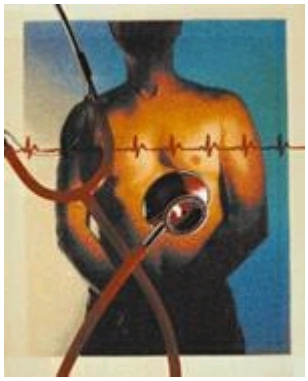
REPORT

Coenzyme Q10 has become one of the better-researched and substantiated "vitamin" supplements. Hundreds of studies document the multiple life-extension benefits of this versatile nutrient, not only as a powerful antioxidant, but also in augmenting the action of other antioxidants such as vitamin C, and in preventing such diseases as heart disease, neurological decline with age, and even periodontal disease.

Making Old Hearts Young Again

Coenzyme Q10: It may, indeed, be a time-reverser.

By Marilyn Bitomsky



Heart attacks and other types of heart disease affect older people to a much greater extent than the young. Young hearts bounce back much better from stress and damage, even the stress of treatment itself. However, treatment with coenzyme Q10 is demonstrating its ability to radically improve the heart's ability to recover from disease and stress.

Scientists in Melbourne, Australia, are giving coenzyme Q10 to elderly people about to undergo cardiac surgery in a bid to make their old hearts young again. Dr. Franklin Rosenfeldt, head of cardiac surgical research at the Baker Institute, says he expects the treatment will make the hearts of people over the age of 70 perform as well as those of 30-year-olds.

Rosenfeldt believes CoQ10 will improve heart function in two ways. The antioxidant fights free radicals released at times of stress, such as during cardiac interventions (including angioplasty, thrombolysis, and surgery). It also improves the way cells convert oxygen and food to energy, strengthening the heart and making it beat more strongly.

People in their 70's and 80's are likely to be those who benefit most, and hence these are the first subjects of a current clinical trial. Rosenfeldt has already achieved good results in laboratory and animal trials.

"We are giving the patients CoQ10 for a week before surgery to build up the energy levels in their cells, and we are testing to see whether their recovery after surgery is better, whether their heart shows less damage, and whether cardiac tissue removed at the time has greater energy capacity and also can stand up to stress better," Rosenfeldt says.

The double-blinded study, which began last June, is being conducted in two phases, a preliminary study involving 60 patients this year and the main study next year. (A double-blind study is one in which neither the subjects nor the persons administering the treatment knows which treatment a subject is receiving.)

Rosenfeldt says the results of cardiac treatments in elderly patients are known to be inferior to those in the young. In fact, the early mortality for elderly patients after such episodes as myocardial infarction, angioplasty, and cardiac surgery is up to three times greater than for younger patients. A possible reason is an age-related reduction in cellular energy transformation during the intervention, which may induce stress. Rosenfeldt expects to find that CoQ10 improves the response to this stress.

Several years ago he conducted a project in which he showed how aging rats respond to stress, and especially how their hearts respond. In treating both elderly (three years old, which is equivalent to an 80-year-old human) and young rats (six months old, equivalent to a 30-year-old human), Rosenfeldt demonstrated that young hearts recovered about 45% after stress, whereas elderly rats recovered only 18%. "There was a much poorer response to stress in elderly hearts," he noted.

In another test, conducted by Dr. Michael Rowland, Rosenfeldt and their colleagues, the rats were given CoQ10 or placebo for six weeks before the same tests were performed again. "In the senescent hearts," they noted, "pre-pacing cardiac work was 74% and

oxygen consumption 66% of that in young hearts. CoQ10 was able to specifically protect the elderly hearts against stress. By comparison, the untreated senescent hearts showed reduced recovery compared with the young hearts. We concluded that senescent rat hearts have reduced baseline function and reduced tolerance to aerobic stress, compared with young hearts. By pre-treating the senescent hearts with CoQ10, the baseline function of the senescent myocardium and its tolerance to aerobic stress was greatly improved." This work has been accepted for publication in *Cardiovascular Research.*

That study was then repeated using human tissues. During open heart surgery, a small piece of tissue was removed from the heart to allow one of the tubes to be inserted for the heart/lung machine. Some of the tissue was tested in the laboratory, where it was put in an organ bath and allowed to contract in a fairly normal environment of oxygen to determine how much force it could generate. "We found we could have tissues from elderly patients or young patients and they all contracted quite well in the organ bath," Rosenfeldt notes.

In the next test, the tissue was subjected to stress in the form of ischemia (reduced blood flow), emulating the effects of a heart attack or cardiac surgery in the piece of tissue. This time, there was a large difference between recovery of the young tissue and elderly tissue, with the young tissue bouncing back by about 60%, but the older tissue recovering only about 40%.

However, when the tissues were incubated in the organ bath with CoQ10 and subjected to the same stress, the result was similar to that found in rats: the elderly tissues from patients aged more than 70 years recovered just as well as the young tissues.

Rosenfeldt said CoQ10 has the potential to improve energy production in mitochondria by bypassing defective components in the respiratory chain, as well as by reducing the effects of oxidative stress. CoQ10 has emerged as a serious candidate for therapeutic use in the amelioration of bioenergetic defects manifested in the elderly heart.

In aged human atrial myocardium-the middle and thickest layer of the heart wall, composed of cardiac muscle-both hypoxia (reduction of oxygen) and simulated ischemia in vitro reveal a reduced capacity to recover pre-stress contractile function, compared with younger tissue. Rosenfeldt found that the frequency of mitochondrial dna deletion may be a useful molecular marker of stress-dependent, age-linked loss of tissue function. However, pre-treatment in vitro with CoQ10 overcomes the reduced capacity of senescent myocardium to recover contractile function after simulated ischemia, compared with younger tissue. (CoQ10 content is decreased in aged myocardium, and this decrease may play a role in the reduced post-stress recovery of contractile function.)

Rosenfeldt presented this work at the inaugural meeting of the International Coenzyme Q10 Society in Boston last May.

In recent years, most of the clinical work with CoQ10 has centered on heart disease, mainly congestive heart failure but more recently as an adjunct to cardiac surgery. Congestive heart failure has been widely reported as being related to significantly low blood and tissue levels of CoQ10, and the severity of heart failure correlates with the severity of CoQ10 deficiency.

Several trials have compared the effect on heart function of giving CoQ10 or placebo, measured by echocardiography. The ejection fraction-the fraction of the blood pumped out of the heart with each beat-showed a gradual and sustained improvement with CoQ10. Moreover, patients reported a reduction in fatigue, difficult or labored breathing (dyspnea), chest pain, and palpitations. The most dramatic results were seen in patients who were started on CoQ10 soon after the onset of congestive heart failure, although those with more established disease also frequently showed clear improvement.

There have now been numerous studies in various countries detailing the use of coenzyme Q10 as a treatment in heart disease. The efficacy and safety of the treatment has been well-established, including in large trials. One study, by Baggio et al., which took place in Italy, involved almost 2,664 patients with heart failure.

A study by Greenberg and Frishman found that 150 mg of CoQ10 reduced the frequency of angina attacks by up to 46%, while improving the capacity for physical activity in those patients. That work was published in the *Journal of Clinical Pharmacology* in 1990.

A study by Sunamori et al. published in 1991 reported that pre-treatment with coenzyme Q10 minimized the myocardial injury caused by cardiac bypass surgery and improved heart function, compared with patients not pre-treated with CoQ10 (*Cardiovascular Drugs and Therapy*, 5, 297-300).

More recently, R.B. Singh, from the Heart Research Laboratory at the Medical Hospital and Research Center in Moradabad, India, told the inaugural conference of the International Coenzyme Q10 Association that, in a randomized double blind trial of 144 patients with acute myocardial infarction, coenzyme Q10 was seen to be associated with a significant reduction in angina pectoris, arrhythmias, and left ventricular dysfunction.

Nonfatal infarction and cardiac deaths also were significantly lower in the coenzyme Q10 group than in the control group.

The future may be bright. At the conference, Dr. Peter Langsjoen noted that we are now at the beginning of an exciting new chapter in the clinical application of CoQ10 due to the rapid increase in public awareness and interest, all stimulating further clinical trials.

History of A Miracle Supplement

Coenzyme Q10, formerly known as ubiquinone, is essentially a fat-soluble vitamin or vitamin-like substance. Present in small quantities in a large variety of foods, it also is synthesized in body tissues. It is involved in several key steps in the production of energy within a cell, and it also functions as an antioxidant, a feature that explains its clinical advantages. It has no known toxicity or side effects.

The antioxidant or free radical-quenching properties of CoQ10 allow it to reduce oxidative damage to tissues. Such properties explain the interest in it as a means of slowing aging and age-related degenerative diseases.

It was first isolated from beef heart mitochondria in 1957 by Dr. Frederick Crane from Wisconsin, and soon afterwards by Professor R.A. Morton in the United Kingdom, who isolated it in rat liver. It was Morton who gave it the name ubiquinone, meaning ubiquitous quinone. In 1958, CoQ10 was synthesized by scientists at the pharmaceutical company Merck & Co.

The first medical use of CoQ7, a related compound, was reported in the mid-1960's by Professor Yuichi Yamamura in Japan, who used it in the treatment of congestive heart failure. Soon afterwards, Mellors and Tappel demonstrated that reduced CoQ6 was an effective antioxidant. In 1972, there was a report by Italian Gian Paolo Littarru and the late Karl Folkers from the University of Texas at Austin of CoQ10 deficiency in heart disease in humans. (The suffix 6, 7 or 10, by the way, refers to a five-carbon hydrocarbon called an isoprene that is attached to the quinone derivative; in mammals, the quinone derivative coenzyme Q usually contains 10 such units...thus, CoQ10).

By the mid-1970's, extensive medical research into CoQ10 became possible after the Japanese perfected the technology to produce it in pure form in large quantities. A few years later, it became possible to measure CoQ10 in blood and tissue by means of high-performance liquid chromatography.

A detailed history of the development and use of CoQ10 was written by Dr. Peter H. Langsjoen in 1994. He concluded that the "clinical experience with CoQ10 in heart failure is nothing short of dramatic, and it is reasonable to believe that the entire field of medicine should be re-evaluated in light of this growing knowledge. We have only scratched the surface of the biomedical and clinical applications of CoQ10 and the associated fields of bioenergetics and free radical chemistry."

Continuation of article at "It's In Your Thoughts"

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