

# CFS is Heart Failure Secondary to Mitochondrial Malfunction

By Dr. Sarah Myhill

[Source: <http://www.drmyhill.co.uk/article.cfm?id=373> ]

I think this is one of the most important handouts I have ever produced in terms of my understanding of CFS and what to do in order to recover! So please read this very carefully and several times over because for many sufferers it contains the keys to unlock their illness!

Two papers have come to my notice recently which make great sense of both my clinical observations and also the idea that CFS is a symptom of mitochondrial failure. The two symptoms I am looking for in CFS to make the diagnosis is firstly very poor stamina and secondly delayed fatigue. I think I can now explain these in terms of what is going on inside cells and the effects on major organs of the body (primarily the heart). More importantly, there are major implications for a test for CFS and of course management and recovery.

If mitochondria (the little batteries found inside every cell in the body) do not work properly, then the energy supply to every cell in the body will be impaired. This includes the heart. Many of the symptoms of CFS could be explained by heart failure because the heart muscle cannot work properly. Cardiologists and other doctors are used to dealing with heart failure due to poor blood supply to the heart itself. In CFS the heart failure is caused by poor muscle function and therefore strictly speaking is a cardiomyopathy. This means the function of the heart will be very abnormal, but traditional tests of heart failure, such as ECG, ECHOs, angiograms etc, will be normal.

Thanks to work by Dr Arnold Peckerman [www.cfids-cab.org/cfs-inform/Coicfs/peckerman.etal.03.pdf](http://www.cfids-cab.org/cfs-inform/Coicfs/peckerman.etal.03.pdf) we now know that cardiac output in CFS patients is impaired. Furthermore the level of impairment correlates very closely to the level of disability in patients. Dr Peckerman was asked by the US National Institutes of Health to develop a test for CFS in order to help them to judge the level of disability in patients claiming Social Security patients. Peckerman is a cardiologist and on the basis that CFS presents with low blood pressure, low blood volume and perfusion defects, he surmised CFS patients were in heart failure To test this he came up with Q scores.

◆Q◆ stands for cardiac output in litres per minute and this can be measured using a totally non-invasive method called Impedence Cardiography. This allows one to accurately measure cardiac output by measuring the electrical impedance across the chest wall. The greater the blood flow the less the impedance. This can be adjusted according to chest and body size to produce a reliable measurement (this is done using a standard algorithm). It is important to do this test in the upright position and again when supine.

This is because cardiac output in normal people will vary from 7 litres per min to 5 litres per min between standing and supine. In healthy people this drop is not enough to affect function. But in CFS sufferers the drop may be from 5 litres lying down to 3.5 litres standing up. At this level the sufferer has a cardiac output which causes borderline organ failure.

This explains why CFS patients feel much better lying down. They have acceptable cardiac output lying down, but standing up they are in borderline heart and organ failure. CFS is therefore the symptom which prevents the patient developing complete heart failure. Actually, everyone feels more rested when they are sitting down with their feet up! The subconscious has worked out that the heart has to work less hard when you are sitting down with your feet up ♦ so we do so because we feel more comfortable!

This means we have a test for CFS i.e. measurement of cardiac output whilst standing and sitting using the Impedence Cardiograph. This test has already been proven in the assessment of disability in CFS ♦ the Q score is an extremely accurate prediction of disability. This is going to be incredibly helpful for sufferers claiming benefits, insurance claims or early retirement. Here is a test which does not rely on belief. It is a completely independent and reliable test of disability. However what this test does not do is tell you why there is disability (i.e. post exertional fatigue). This explains the symptoms of CFS The job of the heart is to maintain blood pressure. If the blood pressure falls, organs start to fail. If the heart is working inadequately as a pump then the only way blood pressure can be sustained is by shutting down blood supply to organs. Organs are shut down in terms of priority, i.e. the skin first, then muscles, followed by liver, gut, brain and finally the heart, lung and kidney. As these organ systems shut down, this creates further problems for the body in terms of toxic overload, susceptibility to viruses which damage mitochondria further, thus exacerbating all the problems of the CFS sufferer.

1. Effects on the Skin If you shut down the blood supply to the skin, this has two main effects. The first is that the skin is responsible for controlling the temperature of the body. This means that CFS patients become intolerant of heat. If the body gets too hot then it cannot lose heat through the skin (because it has no blood supply) and the core temperature increases. The only way the body can compensate for this is by switching off the thyroid gland (which is responsible for the level of metabolic activity in the body and hence heat generation) and so one gets a compensatory underactive thyroid. This alone worsens the problems of fatigue.

The second problem is that if the micro-circulation in the skin is shut down, then the body cannot sweat. This is a major way through which toxins, particularly heavy metals, pesticides and volatile organic compounds are excreted. Therefore the CFS sufferer ♦s body is much better at accumulating toxins, which of course further damage mitochondria.

2. Symptoms in Muscles If the blood supply to muscles is impaired, then muscles quickly run out of oxygen when one starts to exercise. With no oxygen in the muscles the cells

switch over to anaerobic metabolism, which produces lactic acid and it is this that makes muscles ache so much.

As well as the above problem, muscles in the CFS patient have very poor stamina because the mitochondria which supply them with energy are malfunctioning.

3. Symptoms in the Liver and Gut Poor blood supply to the gut results in inefficient digestion, poor production of digestive juices and leaky gut syndrome. Leaky gut syndrome causes many other problems such as allergies, autoimmunity, malabsorption, etc., which further compound the problems of CFS.

If liver circulation is inadequate, this will result in poor detoxification, not just of heavy metals, pesticides and volatile organic compounds, but also toxins produced as a result of fermentation in the gut again further poisoning the mitochondria.

4. Effects on the Brain Last October I attended a conference sponsored by the late Dr John Richardson. A Canadian physician Byron Hyde showed us some functional scans of the brains of CFS patients. If I had not known the diagnosis, I would have diagnosed strokes. This is because the blood supply to some area of the brain was so impaired. The default is temporary and with rest, blood supply recovers. However, this explains the multiplicity of brain symptoms suffered from, such as poor short term memory, difficulty multi-tasking, slow mental processing and so on. Furthermore brain cells are not particularly well stocked with mitochondria and therefore they run out of energy very quickly.

5. Effects on the Heart There are two effects on the heart. The first effect of poor micro-circulation to the heart is disturbance of the electrical conductivity which causes dysrhythmias. Many patients with chronic fatigue syndrome complain of palpitations, missed heart beats or whatever. This is particularly the case in patients with poisoning by chemicals since the chemicals are also directly toxic to nerve cells.

The second obvious result is poor exercise tolerance. Heart muscle fatigues in just the same way that other muscles fatigue. Symptomatically this causes chest pain and fatigue. In the longer term it can cause heart valve defects because the muscles which normally hold the mitral valve open also fatigue.

The difference between this type of heart failure and medically recognised congestive cardiac failure is that patients with CFS protect themselves from organ failure because of their fatigue symptoms. Patients with congestive cardiac failure initially do not get fatigue and often present with organ failures such as kidney failure or overt heart failure. At present I do not know why there is this difference.

**THIS APPROACH TO TREATING HEART DISEASE IS EXACTLY THE SAME REGARDLESS OF THE CONVENTIONAL DIAGNOSIS.** So patients with angina, high blood pressure, heart failure, cardiomyopathy, some valve defects as well as patients

with cardiac dysrhythmias also have mitochondrial problems and will respond in the same way to nutritional therapies and detox therapies.

6. Effects on Lung and Kidney The lung and kidney are relatively protected against poor micro-circulation because they have the largest renin angiotensin system, which keeps the blood pressure up in these vital organs. Therefore clinically one does not see patients with kidney failure or pulmonary hypoperfusion in CFS.

Explanation of the Fatigue Problems in CFS Patients. Energy to the body is supplied by mitochondria, which produce NAD (nicotinamide adenosine diphosphate) and ATP (adenosine triphosphate). These molecules are the  $\diamond$ currency $\diamond$  of energy in the body.

Almost all energy requiring processes in the body have to be  $\diamond$ paid for $\diamond$  with NAD and ATP, but largely ATP. The reserves of ATP in cells are very small. At any one moment in heart muscle cells there is only enough ATP to last about ten contractions. Thus the mitochondria have to be extremely good at re-cycling ATP to keep the cell constantly supplied with energy.

If the cell is not very efficient at re-cycling ATP, then the cell runs out of energy very quickly and this causes the symptoms of weakness and poor stamina. The cell literally has to  $\diamond$ hibernate $\diamond$  and wait until more ATP has been manufactured.

In producing energy, ATP (three phosphates) is converted into ADP (two phosphates) and ADP is re-cycled back through mitochondria to produce ATP. However, if the cell is pushed when there is no ATP about, then it will start to use ADP instead. The body can create energy from ADP to AMP (one phosphate), but the trouble is that AMP cannot be re-cycled. The only way that ADP can be regenerated is by making from fresh ingredients, but this takes days to do. This explains the delayed fatigue seen in chronic fatigue syndrome.

So to summarise, the basic pathology in CFS is slow re-cycling of ATP to ADP and back to ATP again. If patients push themselves and make more energy demands, then ADP is converted to AMP which cannot be recycled and it is this which is responsible for the delayed fatigue. This is because it takes the body several days to make fresh ATP from new ingredients. When patients overdo things and  $\diamond$ hit a brick wall $\diamond$  this is because they have no ATP or ADP to function at all.

Implications for Treatment The vast majority of patients I see get well with my standard work up with respect to vitamins and minerals, diet, pacing, sleep, B12, magnesium, detoxing, etc, etc. All these things must be put in place to repair and prevent ongoing damage to mitochondria so allowing them to recover. For mitochondria to recover they need all the essential vitamins, minerals, essential fatty acids and amino acids to manufacture the cellular machinery to restore normal function.

However, despite doing that, I am still left with a hard core of patients that I still struggle with. This is where direct micronutrient support for mitochondria may prove to be an extremely useful intervention. I have learned what to do through reading a book ♦ The Sinatra Solution ♦ produced by an American metabolic cardiologist, Dr Stephen Sinatra, who has used these techniques for treating patients with heart disease such as congestive cardiac failure, angina, arrhythmias and so on. Sinatra worked initially using entirely conventional techniques ♦ drugs, pacemakers, surgery or whatever. However, he realised that cardiac disease was not all about poor blood supply to the heart. For many the problem was heart muscle disease due to mitochondrial failure. Once he tackled this aspect, patients made dramatic recoveries, were able to come off medication, avoid surgery and return to their normal jobs and sporting activities. To understand his ideas, you need to understand a little bit about how mitochondria work.

**How Mitochondria Actually Work** The job of mitochondria is to get the energy contained inside foods (ie sugars and fats) and convert it into a form the body can use, i.e. NAD and ATP. This requires a series of reactions (Kreb ♦s citric acid cycle for the chemists in the audience!). This process is called oxidative phosphorylation and chemically speaking needs electrons to move about from one molecule to another changing their chemical make up as they go. These reactions require enzymes, which are made up of many different vitamins, minerals, fatty acids and amino acids. However one of the most important electron handlers is Co Enzyme Q 10.

Once ATP has been made, it then has to be delivered to where it is needed, ie out of the mitochondria, through its membrane. This it does with a shunting reaction. ATP is made inside mitochondria from ADP and has to be shunted across the mitochondrial membrane so the cell can use the energy in the ATP by converting it back to ADP. ADP then needs to be shunted back across the cell membrane. This shunting reaction involves acetyl L-carnitine, which effectively shunts energy in the form of ATP from inside mitochondria, through the mitochondrial cell membrane into the cell, where it gives up its energy and converts to ADP. L-carnitine then shunts ADP back through the mitochondrial membrane, where it is reformed into ATP. Obviously, if this shunting reaction does not run smoothly, energy supply will be impaired.

All the molecules involved here are re-cycled. There is another essential element which is magnesium. If you think of glucose and short chain fatty acids as the fuel of the engine, acetyl L-carnitine and Co-enzyme Q10 are the oil and magnesium is the spark plug!

In order to make new ATP, one needs a sugar, namely D-ribose. Normally the body can manufacture this for itself from glucose, but if energy levels are very low, then it may be unable to synthesise this essential sugar. So when the CFS sufferers push themselves too much, ADP is converted into AMP, which they cannot recycle. It normally takes a few days to make new ATP from D-ribose, but the CFS sufferers may be unable to make D-ribose.

In order to make new NAD one needs vitamin B3.

Implications for Treatment - details If the body is functioning normally and has access to all essential minerals, vitamins, essential fatty acids and amino acids, it can make all these essential ingredients, in particular co-enzyme Q 10, acetyl L-carnitine and D-ribose. Magnesium must be supplied. This explains why most patients get well on my standard work up of treatment because this supplies all the essential ingredients for the body to heal itself.

However, for those who do not get well, it is likely that there is some sort of metabolic defect which prevents them from manufacturing these essential ingredients. I call this metabolic dyslexia! It may well be that genetically poor mitochondrial function alone is the problem, or there may be toxins or pesticides stuck in the system which stop the mitochondria functioning properly. It may well be that once the patient has dropped below a certain critical level, all cellular processes are going so slow that the sufferer is unable to manufacture the very things required to restore health. With age, our metabolism becomes less efficient anyway and we may need more raw materials in order to maintain the status quo.

Either way there is a cocktail of micronutrients that could be taken to kick start the system. This cocktail is already of tried and tested value. It has been used in America by many metabolic cardiologists to treat cardiomyopathies, ischaemic heart disease, dysrhythmias, congestive cardiac failures, high blood pressures and anginas with great success. Not only have patients felt better, but they have come off all their medication and avoided life threatening interventions such as cardiac transplants, arterial surgery, pacemakers and so on.

I have yet to try any patients on this cocktail of supplements, so I am looking for guinea pigs. Dr Sinatra has developed several schemes for age management, high blood pressure, arrhythmias, mitral valve prolapse, congestive cardiac failure, syndrome X, for professional and world class athletes, but also for fibromyalgia, chronic fatigue syndrome and mitochondrial cytopathies. He recommends the following daily cocktail for CFS:

Co-enzyme Q 10 300 ♦ 360mg (the oil of the engine ♦ moves electrons from one molecule to another) L-carnitine 2,000 ♦ 3,000mg (the oil of the engine ♦ moves ATP and ADP across mito membranes) D-ribose 15grams (raw material to make new ATP) Magnesium 400 ♦ 800mg (the spark plugs ♦ fires up many enzyme reactions)

To this I would also add niacinamide 500mgs daily (the raw material to make NAD). I would expect this cocktail of supplements to work best taken together, not as individual supplements.

Reference: The Sinatra Solution Metabolic Cardiology Stephen T Sinatra Available from Amazon Incidentally this helps explain why some CFS sufferers have such problems with drug medication and indeed this may help to point towards treatment. All my CFS

patients feel much worse on statins because these stop the body from making its own Co Q 10. Beta blockers, tricyclic antidepressants and phenothiazines also block Co Q 10 synthesis.

Practical Details There is no point taking this cocktail until you have done my standard work up to treating CFS. This is because normally the body is perfectly capable of making its own Coenzyme Q 10 and its own D-ribose so long as it has all the vitamins, minerals, EFAs and amino acids to do so. Vitamin B3 and magnesium comes from supplements and acetyl L-carnitine from red meat.

The supplements in the Sinatra protocol are expensive, so for those who would like to try it I suggest:

Measure levels of Co Q 10 to show there is a deficiency. Phone the office to order a kit, cost £28 (5mls blood red speckled top tube).

Measure NAD levels. Phone office to order a kit, cost £28. (Green top lithium heparin tube)

Measure red cell magnesium. Phone office to order a kit. Cost £17. (Green topped lithium heparin tube)

Eat red meat daily for acetyl L carnitine. Vegetarians will have to take the supplement. If you have poor digestion then you may need to supplement with L carnitine anyway

D-ribose £ I have found a reasonably priced source and can dispense 500gms for £23.

If You Are Found To Be Deficient Co-enzyme Q 10. This must be in a hydrosoluble or oil form or it is not well absorbed. Co Q 10 is fairly widely available £ Lamberts 01892 554 312 do a preparation of 100mgs Co Q 10.

L-carnitine £ this is an amino acid with highest levels in meat. This may explain why vegetarians are at risk of CFS. It also partly explains why my CFS patients do best on high protein diets. Lamberts 01892 554 312 supply L carnitine. Eat red meat (the word carnitine comes from carne £ meat).

D-ribose £ needs to be taken throughout the day.

Niacinamide 500mgs available from Solgar 01782 634 744

Magnesium in Myhill's Magic Minerals (or other such mineral supplement). But if there is a severe deficiency, then magnesium by injection may be required.

How long before you see improvement? Not sure at the moment. However, heart transplant patients whose cardiac output is improved overnight can take up to a year before they start to feel fully well again. However, I would expect sufferers to see improvements after a few weeks of supplements

What is important is that these interventions are done in combination with all my other recommendations with respect to diet, micronutrients, pacing, sleep, detoxing, etc. Firstly get the regime tight, then start to feel better and then start to increase activity.

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