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# JACO

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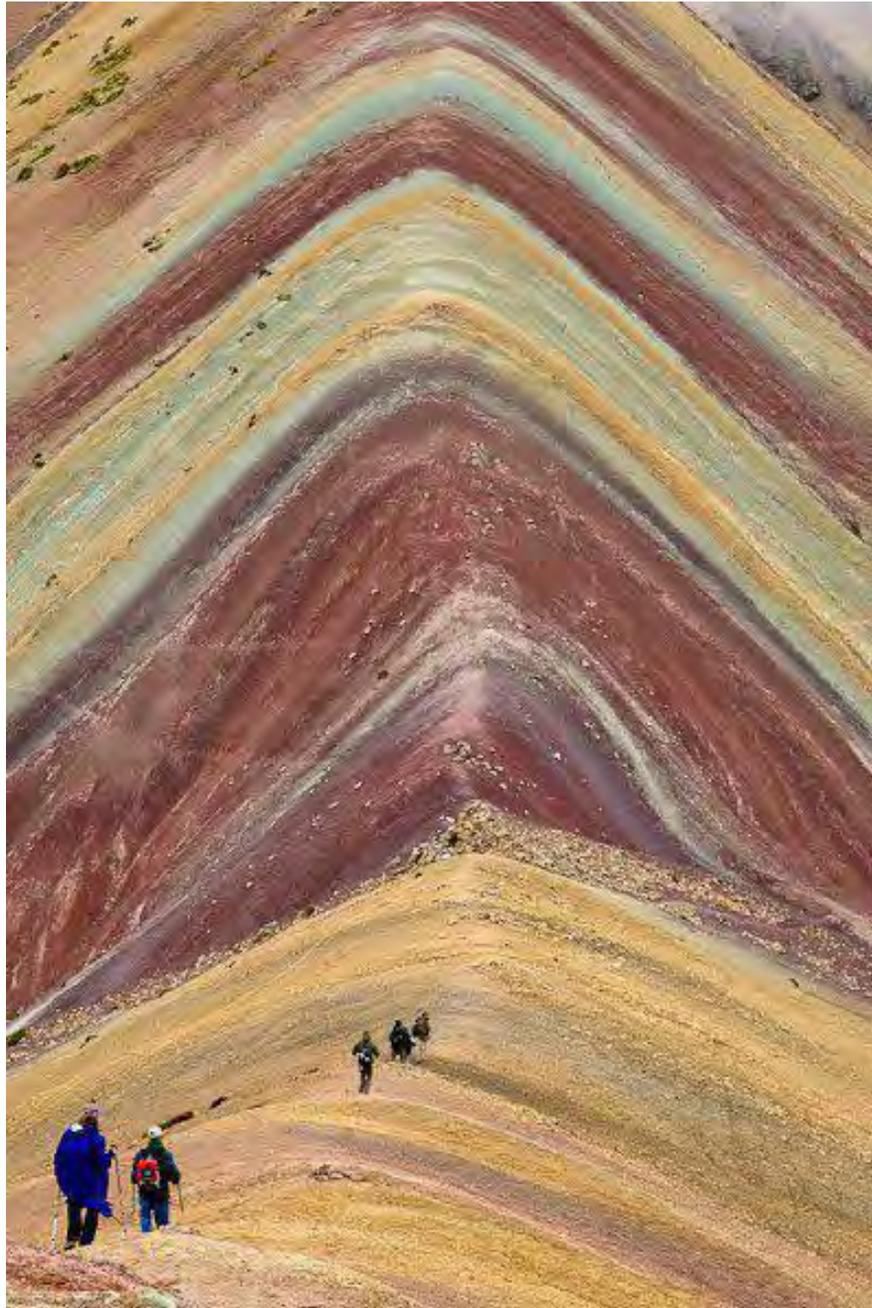
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## Independent Research- Case Study

### **Diagnosis of colorectal cancer in a 75 year old male: A case study.**

**John H. Riggs III, MBA, DC, FACO, Joshua Gaines, MD**

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#### **Abstract**

This case report describes a 75 year old male patient with severe gluteal and posterior hip pain secondary to colorectal cancer (CRC) misdiagnosed as musculoskeletal (MSK) in origin by multiple practitioners. Suspicion of a non-musculoskeletal origin led to referral for a colonoscopy with a subsequent diagnosis of CRC-Stage IIIB. The purpose of this study is to identify missed diagnostic opportunities, point out the need to understand age related risk factors, demonstrate the role of chiropractic physicians in health screening, and raise awareness of the risks of diagnostic overshadowing.

#### **Background**

Timely diagnosis of CRC is a well-known diagnostic dilemma, given that symptoms are often not severe enough to result in aggressive medical care until the cancer metastasizes, at which point available treatment modalities are of limited benefit.<sup>i</sup> Given that CRC is the 2nd leading cause of death for both sexes combined and the 3<sup>rd</sup> leading cause for male and female sexes<sup>ii</sup>, it

is imperative for all practitioners to be familiar with and systematically use screening algorithms.<sup>iii</sup> Adelstein et al<sup>iv</sup> found age as the dominant risk factor with the next most predictive factors being gender, previous colonoscopy, smoker, IBS, prior adenomas, NSAID/aspirin use, the presence of rectal mucus and bleeding, fatigue, and anemia. A systematic review of the literature found that only weight loss and rectal bleeding are statistically associated with CRC.<sup>v</sup> After age 35, CRC incidence increases rising rapidly after age 50 with a peak at age 70.<sup>vi</sup> The National Cancer Institute SEER cancer statistical trends suggest that 1 in 21 men and women will be diagnosed with CRC in their lifetime, with the lifetime probability slightly stronger for men (1.91%) than women (1.31%) between the ages of 50 and 70.<sup>vii</sup> Black men and women followed by white men and women have the highest incidence rate.<sup>7</sup> CRC incidence rates in this population are declining attributable to increased screening and reduced risk factors<sup>viii</sup>, though incidence of CRC in the 40-50 population has begun to increase significantly in recent years.<sup>ix</sup>

Approximately 50% of the Western population develop colorectal tumors by age 70 with 10% becoming malignant.<sup>x</sup> Numerous screening methods for CRC have been suggested to identify risk for CRC. United States Preventative Services Task Force (USPSTF) guidelines recommend CRC screening using fecal occult blood testing, flexible sigmoidoscopy, or colonoscopy in patients aged 50 to 75. The task force does not recommend routine screening in the 76 to 85 years though they note that colonoscopy may be indicated based upon individual clinical considerations.<sup>xi</sup>

Many potential risk factors have been noted for CRC, despite an uncertain mechanism of pathogenesis; for example, there is an inverse relationship between physical activity and risk for CRC<sup>xii</sup> with an overall 24% risk reduction.<sup>xiii</sup> Other factors elevating CRC risk are obesity/BMI<sup>xiv</sup>, waist-to-hip ratio/abdominal adiposity<sup>xv</sup> and height.<sup>xvi</sup> Red meat consumption and dietary fiber risk factors are inconclusive at this time.<sup>xvii</sup> Other factors associated with increased CRC risk include: smoking, alcohol intake, family history of colon cancer, regular NSAID use, multivitamin use, diabetes, and race.<sup>xviii</sup> The Western diet,<sup>xix</sup> consisting of large amounts of highly refined carbohydrates and red meat and inadequate fiber, has not only been strongly associated with CRC it has also been associated with a higher risk of recurrence and mortality.<sup>xx</sup>

Several preventative considerations have been suggested. The chemo protective use

of cyclooxygenase (COX) inhibitors (e.g., sulindac, celecoxib), which prevent the conversion of arachidonic acid to inflammatory prostaglandins, has been shown to reduce CRC risk.<sup>xxi</sup> Wacktaowski-Wende et al did not find any benefit for daily calcium plus vitamin D in the prevention of CRC in postmenopausal women.<sup>xxii</sup> Poynter et al<sup>xxiii</sup> found a 47% risk reduction in those taking statin drugs, which is consistent with the findings of Otani et al,<sup>xxiv</sup> who found a positive correlation with elevated serum triglycerides and CRC risk.

An extensive research of the case literature turned up a single missed diagnosis case in an elderly male using surveillance ileocolonoscopy (SI).<sup>xxv</sup> Wang et al noted CRC had a risk of being missed 3 times more often after colonoscopy in cases with concomitant inflammatory bowel disease in older patients supporting the need for intensive surveillance colonoscopy.<sup>xxvi</sup> No other relevant cases were reported. All other cases found were reports of unusual metastasis or CRC pathologies that were non-adenocarcinomas.

### **Case Presentation:**

A 75 year old retiree presented to a chiropractic clinic in considerable distress complaining of severe coccyx, left gluteal and posterior hip region pain of one year duration. Pain severity had progressed from 4/10 and intermittent to 10/10 and constant burning pain over 10 months. He could not recall any trauma or insult in particular that led to the pain. Partial relief was noted with

constant motion. Treatment by the following practitioners for MSK related pain did not bring relief: family practitioner, orthopedic surgeon, pain management specialist, acupuncturist, chiropractor, and a neurosurgeon.

Physical examination was difficult due to the patient's extreme pain, prior stroke, inability to hold any position for more than 1-2 minutes, and severe deafness resulting in all communication through his wife. Observationally, he was anxious and attempted to find relief by constant movement. Lumbar ROMs, Bechterew's, and Kemp's did not elicit any change in the current pain level. Deep tendon reflexes were 2+/4 bilaterally. Prone examination revealed a 1" left leg length discrepancy, posterior rotation of the ilium and a tight right piriformis. Constitutionally, the patient was well nourished and reported no weight loss. A non-contrast lumbar MRI report (one month prior) was provided demonstrating degenerative disc disease at L2-3 and L3-4 with facet degenerative arthritis at L3-4, L2-3, L4-5 and L5-S1, no foraminal encroachment, and a Schmorl's node at L4.

Past medical history included: hernia repair, hemorrhoidectomy (40 years prior), and hospitalization 2 years prior for an anterior communicating artery aneurysm (monitored), evidence of slight stroke two years prior. Noted medications included: tramadol, naproxen, carvedilol, lisinopril, and amlodipine besylate. Review of systems: occasional chest pain and irregular heartbeats with hypertension, recent

hemorrhoid problems with constipation and diarrhea, nocturnal polyuria, occasional dizziness, depression, memory loss, deafness and some arthritis in the neck and back. No prior history of cancer noted. Family medical history: father deceased age 63 (accident); mother deceased age 79 (breast cancer complications).

Following the initial workup, and while attempting to identify the pain generator, a tentative working MSK diagnosis, due to some relief with movement, was rendered. Other initial differentials included osteoarthritis, piriformis syndrome, pressure neuropathy, and ultimately cancer. Red flags of recent bowel related symptoms and complains with hemorrhoid recurrence and his excruciating pain, as well as falling within the 50-75 age range were noted. There was no additional information favoring a diagnosis of cancer given the lack of Fecal Occult Blood Tests (FOBT), colonoscopy, CEA (carcinogenic embryonic antigen) lab markers, or the availability of other provider medical records.

Initial treatment consisted of 3 successive days of outpatient observation, low force musculoskeletal and soft tissue manipulation to identify pain generators and rule out a MSK cause. A CRC diagnosis was suspected and inquiry as to whether a digital rectal exam (DRE) or recent colonoscopy had been performed was negative. Immediate referral was made to his family physician. The gastroenterologist, although initially reluctant, agreed due to the length of time since his last colonoscopy and his wife's insistence.

The pathology report from a colonoscopy performed approximately 2 weeks post referral revealed a large ulcerative rectal mass with continuation close to the anal region occupying 2/3 of the wall of the rectum. Additionally, a 5 mm rectal polyp 2 cm superior to the rectal mass was noted. Abdominal and pelvic visualization demonstrated asymmetric wall thickening in of the rectum consistent rectal adenocarcinoma with probable adjacent left-sided perirectal adenopathy. Additionally, the CT report notes subjective persistent narrowing of the colon at the junction of the sigmoid colon and rectum and tentatively attributes it to focal spasm. Examination of the area adjacent to the rectum revealed a small oval mass measuring 7 x 11 mm, with similar masses were also noted nearby. Additionally, no periaortic or inguinal adenopathy was noted. Finally, diverticulosis, multiple hepatic cysts, small right kidney cyst, melanosis coli, early diverticula and a small hiatal hernia were also noted.

The primary mass was identified as a moderate to poorly differentiated adenocarcinoma measuring 5.5 cm with involvement in 3 of 26 lymph nodes and three tumor implants.. The tumor staging shows invasion through the muscularis propria into the pericorectal tissues, with a final staging of III-B.

Prior treatment records were obtained after referral. Treatment for the complaint included the following: family medical doctor, orthopedic surgeon, neurosurgeon,

pain management specialist, chiropractor and acupuncturist. Medical records reflected considerable variation in the complaint history among providers. A pelvis/left hip MRI report showed degenerative changes. Differential diagnoses were absent from all but the orthopedic surgeon. Red flags were written off to other concerns or ignored, including: worn out weak feeling, bowel incontinence, constipation, irregular bowels, rectal bleeding, and fatigue. Treatment included: facet injections, epidural steroid injections, pain medications, sacroiliac joint injections, piriformis muscle injections, acupuncture, physical therapy, low force manipulation, and a dorsal column stimulator with no relief. The persistent pursuit of a focused diagnosis related to the MSK system, without considering other options, is an example of diagnostic overshadowing. Post referral cancer treatment included: surgery, chemotherapy and refused radiation therapy over the next year, with chemotherapy suspended treatment due to an allergic reaction. The patient returned approximately one year later still suffering from intractable and severe pain. He was referred to pain management and subsequently developed complex regional pain syndrome (CRPS). A spinal pump was placed and efforts were made to ease his pain and he died 3 months later from CRC complications.

### **Conclusion:**

This case demonstrates the need to pursue a broad differential in the presence of lower-back pain and clinical symptoms

inconsistent with a MSK etiology. CRC grows slowly in the early phases and does not always present with symptoms severe enough to seek aggressive medical attention. The most common diagnostic pitfall in such cases is premature closure. Had prior providers recommended a colonoscopy or performed a DRE, the resulting comorbidities could have been averted. Given early detection and intervention in CRC is critical all patients in the 50-75 age range should be screened appropriately. Although typical CRC lifestyle characteristics were absent in this case, several red flags were missed during treatment. Given the rapid progression of metastatic CRC, it is imperative all practitioners consider it in the differential of lower back pain to reduce morbidity and mortality.

Chronic pain is prevalent in the general populace and particularly with cancer patients. Although neuropathic pain definitions have evolved over several decades, Costigan et al have described it as an expression of maladaptive neuroplasticity due to several changes in the nociceptive system, with common causes including: mechanical trauma, metabolic diseases, neurotoxic chemicals, infection and, as in the case of this patient, direct tumor invasion.<sup>xxviii</sup> Neuropathic lesions in cancer patients are frequently caused by tumor invasion or compressive forces on the nerves.<sup>xxix</sup> Maladaptive neuroplasticity explains the development of complex regional pain syndrome (CRPS) and the concomitant intractable pain experienced by the patient. Bottros suggests pain

management needs to move from a symptom suppression paradigm to more of a disease-modifying strategy to prevent the development of neuroplasticity and chronic pain.<sup>xxx</sup>

Clinical decision making in this case demonstrates “diagnostic overshadowing” where a MSK causation was endlessly pursued in spite of lack of clinical response and clinical information suggesting other considerations.<sup>xxxi</sup> No evidence of a CRC differential was found, although the chiropractic physician did recognize other possibilities needed consideration and offered to send out the MRI for a re-review. The paper also demonstrates several of the diagnostic challenges present in older patients.<sup>xxxii</sup>

Several areas for future study to determine the readiness of chiropractic physicians to provide screening information for health care cost control are apparent. What educational exposure do field doctors have on United States Preventative Services Task Force (USPSTF) screening criteria and risk factors?<sup>xxxiii</sup> Do field doctors regularly screen for and identify risk factors with current patients? What is an appropriate role for chiropractic physicians in CRC prevention? These are all questions that should be addressed in future study.

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## Abstracts & Literature Review

### **Micronutrient Deficiencies, An Unmet Need in Heart Failure**

Soukoulis V, Dihu JB, Sole M, Anker SD, Cleland J, Fonarow GC, Metra M, Pasini E, Strzelczyk T, Taegtmeier H, Gheorghiade M.

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#### **Authors' Abstract:**

Heart failure (HF) is a common, disabling, and costly disease. Despite major advances in medical therapy, morbidity and mortality remain high, in part because current pharmacological regimens may not fully address some unique requirements of the heart for energy. The heart requires a continuous supply of energy-providing substrates and amino acids in order to maintain its function. In HF, defects in substrate metabolism and cardiac energy and substrate utilization may contribute to contractile dysfunction. HF is often accompanied by a deficiency in key micronutrients required for unimpeded energy transfer. Correcting these deficits has been proposed as a method to limit or even reverse the progressive myocyte dysfunction and/or necrosis in HF. This review summarizes the existing HF literature with respect to supplementation trials of key

micronutrients involved in cardiac metabolism: coenzyme Q10, L-carnitine, thiamine, and amino acids, including taurine. Studies using a broader approach to supplementation are also considered. Although some of the results are promising, none are conclusive. There is a need for a prospective trial to examine the effects of micronutrient supplementation on morbidity and mortality in patients with HF.

#### **Background**

A distinguished list of authors begin with an overview of HF and a brief synopsis of normal cardiac metabolism. Of particular note is a reminder that “every 30 days, an entire heart is reconstructed with brand new protein components, using a steady supply of nutritional building blocks in the form of amino acids, lipids, and carbohydrates.” They define macronutrients as fats and carbohydrates whereas micronutrients are

listed as coenzyme Q10, L-carnitine, thiamine, amino acids, including taurine, and other small molecules that serve as essential cofactors. They next discuss cardiac metabolism seen in heart failure, especially as it relates to deficiencies in nutrients. Here they emphasize that the heart is “not out of fuel” but rather lacking in key nutrients; restating the “over fed – undernourished” paradigm of many nutritionists. The authors further opine that treating deficiencies with micronutrients can prevent heart cell death and restore function especially in cases where commonly prescribed medications may be lowering micronutrients. Of notable interest is a table listing “Guideline Recommendations for Nutritional Support in HF”. The American College of Cardiology, the American Heart Association, and the Canadian Cardiovascular Society do not recommend nutritional supplements in HF therapy. I applaud these authors for taking what is otherwise a very unpopular stand.

## Methods

This paper is a review article extracted from a search of 179 references, eight of which specifically studied CoQ10 and six studied L-Carnitine. They also discuss other references which studied a variety of B vitamins, Amino Acids, and other micronutrients such as creatinine, vitamin D, magnesium, potassium, zinc and selenium. The authors suggest that the “single supplement” approach may be a limiting factor in many of the clinical trials and recommend that a combination of

supplements as seen in some animal experiments might prove more fruitful.

## Results

The authors conclude that CoQ10 shows good promise as a supplement for the treatment of HF. They site both statistically significant improvements and adverse side effects. One study stated that the average daily intake of CoQ10 was 5mg. The authors reported that trials involving CoQ10 used dosages from 60 to 300 mg/day. Other than dividing the daily dose to no greater than 100 mg at a time, no suggestions were reported to minimize the adverse side effects. I hope that the reader will not fall into the trap of believing that if a little is good, a lot is better. The authors also appear to be caught up in the highly controversial antioxidant paradigm by citing several apparently good things that antioxidants can do, including preventing “the activation of apoptotic cascades.” Knowing that apoptosis is normal cell death, why would the authors embellish the inhibition of this process? Furthermore, the eventual effect of antioxidants robbing the heart muscle of valuable oxygen does not appear to be a consideration of these authors. L-Carnitine was reported to be supplied primarily from the diet and that deficiencies in patients with HF are well documented. Any amounts produced endogenously come from Lysine and Methionine, two of the essential amino acids. Regardless of the benefits or dangers, the authors do not address the origin or quality of the L-Carnitine supplements. The common practice of over cooking protein foods and

the governmental mandates to roast or pasteurize nuts has placed consumers in a state of protein malnutrition in an otherwise over-fed society. Stated another way, when proteins are broken down into less than amino acid fragments they must be reconstructed to be useful for non-caloric needs. The essential amino acids cannot be constructed by the body and substances like L-Carnitine, (manufactured from two essential amino acids) are at risk of becoming deficient when both dietary and endogenous production components are destroyed by cooking. Proteins can also be denatured by salt concentration, freezing, ultrasonic stress and aging.

The authors next discuss a number of B vitamins citing that the cardiac effect of thiamine deficiency is referred to as wet beriberi. Other B vitamins play critical roles in carbohydrate metabolism and red blood cell production. The reader is reminded that B vitamins are water soluble and thus cannot be stored in the body. This class of vitamins is adversely affected by diuretics and other medications common in the treatment of HF. No mention is made of the potential to make all other B vitamins deficient when supplementing only one. The application of a full spectrum B vitamin complex should be a simple matter when conducting further studies.

Amino Acids become the next subject of discussion. The authors focus here is taurine, which is not truly an amino acid but is derived from methionine and cysteine. The same disadvantages that befall over cooked proteins and amino acids discussed

earlier apply here but to a lesser extent in that cysteine is not an essential amino acid. The principle effect of taurine on cardiac function is that of regulating voltage-dependent calcium channels. Mere supplementation of taurine may not be an adequate answer to this area of study. Adequate intake of usable calcium, which is affected by both vitamin D and F, becomes a threefold dilemma that must be considered before taurine supplementation can be reasonably applied. Additionally the authors point out that heart muscle cells require protection from both calcium overload as well as low calcium states. No mention is made in this paper of the “tug-of-war” that exists between vitamin D and F with calcium stuck in the middle.

Other micronutrients are listed by the authors as having a potential effect on HF. They report on studies suggesting that deficiencies in creatinine, vitamin D, magnesium, potassium and zinc are all seen in HF.

The last area of consideration was a report on studies of “multiple-micronutrient supplementation”. The authors suggest that in single supplement studies “rate-limiting steps” may simply shift to another nutrient deficiency. Both animal and human studies are cited with benefits seen in the supplementation groups across the board. The authors were conscientious to point out the study limitations in the human trials. From the perspective of one who has utilized whole-food nutrition for years in clinical practice, I am concerned that the quality and origin of the supplements used

in the trials were more than likely man-made synthetics, loaded with antioxidants. My experience has shown that while these supplement regimens can show promise, improved results can be seen with products derived from a more natural approach.

## Conclusions

The authors conclude that while numerous studies in the area of nutritional supplementation and HF are available, none have hit that much needed home run. This area of study is in a state of relative infancy.

## Clinical Relevance

The clinical relevance for the chiropractic orthopedist is to more courageously use nutritional supplementation in patients suffering from HF or any of the vast cardiac diseases. This group of authors have mined 179 studies and published their suggestions regarding nutritional supplementation in a journal whose parent association believes that nutrition is unproven and not recommended in the treatment of HF. As always, the healthcare industry should look to the chiropractic community for guidance in the use of natural methods of healing and we owe it to our patients and our profession to lead the charge within this arena.

## JACO Editorial Summary

1. A steady supply of nutritional building blocks in the form of amino acids, lipids and carbohydrates is needed to provide for the constant turn over and rebuilding of the heart.

2. The metabolic cascade of energy production within the heart is extensive and requires numerous micronutrients including vitamins, minerals and proteins.
3. While many elements of high quality research are missing from the data base considered here, it appears that micronutrients such as CoQ10, L-carnitine, B vitamins, amino acids, creatine, vitamin D, magnesium, potassium, zinc, and selenium show promise in the treatment of HF.
4. Studies investigating a single micronutrient may be limited by other deficiencies and thus provide poor results when a broader spectrum approach to supplementation may work better.
5. To date, no single trial conducted has met the necessary criteria to demonstrate a significant clinical benefit when 1 or more micronutrients were added to standard therapy for HF.

## Summary

While the authors were left to glean what information they could from studies of marginal quality, they remained encouraged that micronutrient supplementation in patients being treated for HF could be beneficial. Sufficient positive results were seen in these papers to recommend further investigation into this area. Because of the numerous components involved in cardiac energy metabolism, they recommend a broad spectrum supplementation program rather than trying to find the one magic bullet for HF sufferers.

## Abstracts & Literature Review

# Neuroprotection by spice-derived nutraceuticals: You are what you eat

Kannappan R, Gupta SC, Kim JH, Reuter S, Aggarwal BB

Mol Neurobiol 2011 October; 44(2): 142-159, doi: 10.1007/s 12035-011-8168-2

JACO Editorial Reviewer: J. Christopher Romney, D.C., F.A.C.O.

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### **Study Design:** Literature Review

### **Objective**

Evidence indicates that chronic inflammation plays a major role in the development of various neurogenic diseases.

### **Summary of back ground data**

Life style factors have been linked to the development of neurodegenerative diseases. These diseases are more common among people from some countries than others and examine the countries that consume certain spices to the western world. In India, for example, Alzheimer's disease is less prevalent at a rate of 0.7- 3.1% of North Americans among the age group of 70-79.

### **Methods**

Reviewing the data indicates that the incidence of neurodegenerative disease

among people living in the Asian subcontinent is much lower than that in North America. The studies look at the spices utilized in certain countries and its effect on the nervous tissue as neuroprotectants. The spices act as antioxidants and significantly reduce the inflammatory cell in the central nervous system.

### **Results**

Asian subcontinents have a much lower prevalence of neurodegenerative diseases than that of North America. India for example utilizes the yellow curry spice and curcumin which both have antioxidant and anti-inflammation properties. Curcumin specifically confers significant protection against neurotoxin and genotoxic agents. Twelve neurological conditions were studied analyzing biochemical interaction and

neuroprotective benefits found with curcumin.

## **Conclusion**

Although spices have been used for more than 2,000 years, most of their biological activities have been discovered only in the last decade. Modern drugs have been disappointing due to side effects, therefore spice-derived nutraceuticals against various neurodegenerative becomes more evident. These nutraceuticals may be developed as new drugs against Alzheimer's, Parkinson's, or other neurodegenerative maladies.

## **Clinical Relevance**

The research outlined in this study has merit to the Chiropractic practice, especially the awareness of the potential dangers of inflammatory foods that risk the health of the nervous system. These studies show the neuro-chemical degenerative changes that occur and the differences that certain spices have in reducing and inhibiting the aging process. Chiropractic practices involve preventive measures through nutrition counseling and education. The research gathered in these papers has valuable benefit in the prevention of disease, and the understanding of the neurodegenerative processes. The study exposes the American diet as anemic in spices that can offer antioxidant and anti-inflammatory

properties. We can learn from this information and realize the potential to eating less inflammatory foods and increase the anti-inflammatory spices that may reduce the risk of neurodegenerative diseases.

This article could be a great catalyst to direct further research in the medical treatment of the various neurological diseases to improve outcome and prevention. This research omits other influences to neurodegenerative that western civilization causes such as chemical exposure, food preservatives, dyes, and vaccines. I do see the details gathered in this study to be of value but more needs to be addressed as medical care is providing the patient with a longer life span yet the quality of life is declining.

## Abstracts & Literature Review

### Potential pathophysiological role for the vitamin D deficiency in essential hypertension

Carbone F, Mach F, Vuilleumier N, Montecucco F

World J Cardiol 2014 May 26; 6(5): 260-276

JACO Editorial Reviewer: Jonice Owen, D.C., F.A.C.O., D.A.C.R.B., Ms.Appl.

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#### Authors' Abstract:

Vitamin D deficiency has been indicated as a pandemic emerging public health problem. In addition to the well-known role on calcium-phosphorus homeostasis in the bone, vitamin D-mediated processes have been recently investigated on other diseases, such as infections, cancer and cardiovascular diseases. Recently, both the discovery of paracrine actions of vitamin D (recognized as “local vitamin D system”) and the link of vitamin D with renin-angiotensin-aldosterone system and the fibroblast growth factor 23/klotho pathways highlighted its active cardiovascular activity. Focusing on hypertension, this review summarizes the more recent experimental evidence involving the vitamin D system and deficiency in the cardiovascular pathophysiology. In particular, we updated the vascular synthesis/catabolism of vitamin D and its complex interactions between the various endocrine networks involved in the

regulation of blood pressure in humans. On the other hand, the conflicting results emerged from the comparison between observational and interventional studies emphasize the fragmentary nature of our knowledge in the field of vitamin D and hypertension, strongly suggesting the need of further researches in this field.

#### Objective:

**Core tip:** This review provides a comprehensive and critical analysis of the most recent studies investigating the relationship between vitamin D and essential hypertension. From the both observational and interventional studies, conflicting results have been shown. This review article provides some hypothesis to explain these discrepancies. In addition to the potential bias related to the study design, some pathophysiological explanation was suggested, especially involving the potential role of local vitamin D system as well as the

fibroblast growth factor 23/klotho axis. This review aims at suggesting a careful reflection so that future studies might be designed to minimize bias and encompass the complex biology of vitamin D system.

### **Introduction:**

Vitamin D deficiency has recently emerged as a public health problem, affecting almost 50% of the population worldwide. Contributing factors include: reduced exposure to sunlight, genetic and environmental factors such as pollution, diet, sedentary life style and stress. Vitamin D not only acts as a pivotal mediator of calcium metabolism and skeletal health, but also regulates several cell functions, including differentiation and metabolism. Hypovitaminosis D has been proved to be an independent risk factor for overall mortality in various cohort analyses, and vitamin D supplementation significantly reduced mortality. This article focuses on the potential relationship between vitamin D and cardiovascular (CV) disorders, and although the causal relationship between them remains unknown, physiologic understanding of the roles of vitamin D does exist. These roles include fibroblast growth factor (FGF) 23-klotho axis, non-genomic effects of vitamin D and the paracrine effects of vitamin D (also called “local vitamin D system”). A primary focus of the article is the sequence of mechanisms triggered by vitamin D in arterial hypertension, starting from the complex interplay with the reninangiotensin-

Aldosterone system (RAAS) in both basic research and clinical trials.

### **Results:**

Many questions recently emerged from efficacy and safety in interventional trials using vitamin D supplementation. In experimental mouse models, excessive intake of vitamin D induces vascular and soft-tissue calcifications. Thus, in humans, caution has to be used on the pro-calcifying effects of exogenous vitamin D. In addition to derangement in calcium homeostasis, it should take into account the detrimental effects of vitamin D-induced phosphate overload involving also FGF23/klotho axis. On the other hand, the definition of the optimal vitamin D status from a CV point of view remains matter of debate and general consensus is still missing. “Bone health-driven” recommendations agree to define insufficient a 25(OH) vitamin D levels < 20 ng/mL, suggesting a target of 30 ng/mL. Similarly, reports from large cohorts (such as NHANES[164] and The Framingham offspring study[165]) showed a linear inverse association with CV outcome for 25(OH) vitamin D levels up to 30ng/ mL. Considering hypertension, the results from the vitamin D and Omega-3 Hypertension Trial (VITAL Hypertension) that is still enrolling patients [166] might clarify this point. Finally, the “local vitamin D system” is emerging as a pivotal topic that might explain the conflicting results between observational and interventional trials [167].

### **Conclusion:**

Neither the European society of Cardiology nor American Heart Association have published CV-focused algorithms regarding vitamin D deficiency because the first results from randomized clinical trials have provided more questions than answers. Certainly, several factors involved in vitamin D biology are under-recognized or hard to assess, including physical activity, sunlight exposure, health status or dietary habits. Moreover, several confounding factors have not been considered in several studies, such as comorbidities, concomitant medications or differences in gender, age and race. In addition, vitamin D compounds proposed were highly variable, ranging from native (cholecalciferol or ergocalciferol) or synthetic ( $\alpha$ -calcidol) inactive vitamin D to active vitamin D (calcitriol) up to selective VDR activators (paricalcitol). However, it is likely that other unidentified factors are also involved in vitamin D biology, such as the possible relationship with other endocrine networks, emphasizing the need of pre-clinical studies.

### **Study Design, Methods and Summary of Background Data:**

This review of Clinical Studies follows this format: Ref., Year, Study design (sample size), County (ethnicity) Age, Correlation (lower reference range of 25 (Oh vitamin D), Findings.

Three sections are devoted to the study types, and includes a concise description of the study type, key points of the studies as well as study limitation.

Table 1 Cross-sectional studies evaluating vitamin D blood pressure (this table outlines 32 studies); Table 2 Longitudinal studies addressing the associations between vitamin D and blood pressure (this table outlines 10 studies); Table 3 Randomized clinical trial investigating the protective effect of vitamin D supplementation on blood pressure (this table outlines 22 studies).

### **Clinical Relevance:**

This study focuses on the relationship of vitamin D deficiency in essential hypertension which is a topic of interest in our patient population. Additionally, the detailed physiological pathways described including the local vitamin D system (panacrine action of vitamin D) lend greater understanding to the far reaching effects of vitamin D.

### **JACO Editorial Summary:**

1. In humans, more than 80% of vitamin D requirements are produced through the ultraviolet-B (UVB)-induced conversion of 7-dehydrocholesterol to vitamin D in the skin, whereas, only 10% - 20% is absorbed with the diet.
2. Vitamin D receptor (VDR) is a member of the nuclear hormone receptors superfamily.
3. Physical activity, sunlight exposure, health status, dietary habits, as well as confounding factors such as comorbidities, concomitant medications or differences in gender,

age and race contribute to vitamin D biology.

4. This article delivers concise descriptions of physiologic and pathophysiologic pathways regarding vitamin D.
5. Further study will contribute to our knowledge base and suggested inclusion of the possible relationship with other endocrine networks is suggested.
6. Detailed tables will help the reader understand the current research on the topic of the relationship of hypertension and vitamin D.
7. Interrelationships of vitamin D synthesis, vitamin D receptors, kidney, parathyroid hormone (PTH)

and the skin are included in the detailed background discussion.

## **Summary**

The results of this intensive inquiry into the pathophysiological role of vitamin D deficiency in essential hypertension raises our awareness and understanding of the pivotal role vitamin D plays in the complex regulatory relationships in the cardiovascular system. This offers us greater understanding of the role of vitamin D in a myriad of cascading physiologic events which occur throughout the body.

## Abstracts & Literature Review

# Diagnosis and management of bone stress injuries of the lower limb in athletes

Pegrum J, Crisp T, Padhiar N

BMJ 2012;344:e2511 doi: 10.1136/bmj.e2511

JACO Editorial Reviewer: Donald S. Corenman, M.D., D.C.

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### Authors Abstract and Summary

#### Points:

The annual incidence of overuse injuries in track and field athletes is estimated to be 3.9 per 1000 training hours, with a prevalence of 76% and 10-20% of consultations in sports medicine practice are for stress fractures. Stress fractures are also common among army recruits.

With the advent of magnetic resonance imaging (MRI), stress fractures are diagnosed earlier and more readily than they were in the past, and early surgical treatment is increasingly considered as a management option for patients who are at high risk of fracture non-union. Rapid and accurate diagnosis of stress fractures is important to prevent propagation of the fracture, and early effective treatment may reduce time away from training and participation in sport. Experts think that overtreatment of

low risk stress injuries and under treatment of high risk injuries both occur and lead to unnecessary time away from training. In addition, increasing participation of non-athletes in endurance sports such as marathon running has led to an increase in stress injuries among non-professional sportspeople.

1. Stress fractures occur mostly in track and distance runners, athletes who take part in field sports, gymnasts, dancers, and military recruits.
2. Consider the diagnosis in sports people with risk factors for bone injury and progressively worsening localized bone pain.
3. Women with the “female athlete triad” are especially at risk of bony stress injury.
4. MRI is the most sensitive and specific imaging modality for

- diagnosing stress fractures.
5. Stress fractures with low risk of non-union can be managed in primary care by modifying sports activity and reducing risk factors.
  6. Involvement of a specialist is necessary for fractures at high risk of non-union and operative fixation may be considered.

## Background

This paper is a review article of lower extremity stress fractures including the potential vulnerable population, the diagnosis, and the treatment of these fractures.

## Methods

The authors searched three separate medical on-line libraries using key words; “stress fracture”, “stress injury”, and “stress reaction” to write this document. These authors also used their prior clinical experience while putting this paper together.

## Results

This paper notes that the two groups that have the greatest risk of stress fractures are the athletic and the military populations. In either population, prolonged impact activities (running, weight lifting and calisthenics) set the stage for these overuse fractures. The paper also noted that insufficiency fractures (related to reduced impact activity but inferior bone stock generally in the elderly) are also included in this group.

Symptoms of this disorder are identified in these groups and include localized pain with impact activities that increase in intensity and with prolonged impact or stress exposure. If the fracture develops further, localized swelling and tenderness are noted. Day to day pain with normal activities is an indicator of a progressive fracture.

Risk factors are identified with a thorough history and physical examination. These factors include female status, menstrual irregularities, and less muscle mass in the lower extremities. In fact, females who had five or less menses per year had almost double the risk of stress fractures compared to those who had a normal menstrual cycle. Interestingly, oral contraceptives reduced the chances of developing stress fractures.

The typical location of these fractures is identified as well. Tibial stress fractures are the most common at 50% of all stress fractures. Metatarsal stress fractures occur under 20% of the time and femoral shaft and neck fractures exist at about a 10% occurrence rate.

Also noted in this paper are the potential risks and healing outcomes for fractures in different locations. As would be expected, fractures with reduced vascularity (the anterior tibia and navicular) had poorer outcomes due to this relative avascularity. If a fracture of the femoral neck develops and then displaces, the chance of avascular necrosis to the femoral head is very high due to the retrograde vascularity of the femoral head.

This paper reports MRI as the leading tool for confirming the diagnosis after a suspicion of stress fracture is considered. Prior to the development of MRI technology, bone scan and CT scan were utilized but had a much lower sensitivity for this injury. Now, with the ability to visualize the interstitial fluid within the bony matrix from the fractures of the trabecula and laminar layers of the cortical bone, identification can occur much earlier. This is especially noted with STIR images.

The authors note the interesting crystalline material structure of bone. A fatigue fracture of a long bones is not uncommon under significant repeated load. It makes us realize that long bones are just like any brittle structure that can be overstressed. This goes back to the stress/strain curves in materials management in physics.

## Conclusions

Bone, like any crystalline structure has a fatigue point for gross failure (overt fracture) and a failure point for repeated stresses that do not individually reach the gross failure point. These stresses accumulate over time with repeated loads. This is a time related function. Stress fractures overwhelm the ability of the bone to heal without rest (time). It is remarkable that bone has a self-healing process and can recover from these less than full structural failure injuries given time and rest.

This paper makes it important to identify the patients at higher risk for stress fractures. This diagnosis has to be on the practitioner's

radar screen to be able to make the diagnosis and prevent serious sequelae such as a completed fracture of the tibia or even the need for a hip replacement due to avascular necrosis of the femoral head.

Questions such as how many menses the patient has had in the last year are not typical questions associated with a new patient admission to the chiropractor's office but may aid in accurate diagnosis. This article helps practitioners understand the significance of this question (among others) with a young athletic female who complains of leg pain. Sir William Osler's famous quote, "You find what you know and you see what you look for" applies here (as well as in most circumstances in medicine).

## Clinical Relevance

Differential diagnosis of unexplained localized pain in the lower extremity of athletic or military personnel should include stress fracture with the resultant work-up necessary to diagnose this disorder.

Lower extremity insufficiency fractures due to osteoporosis are more common than we estimate. The alert practitioner needs to be especially careful to identify and treat these patients. A positive log roll test of the hip may be an early warning sign of femoral neck stress fractures. Any unexplained lower extremity pain that increases with stress has to be considered a possible fatigue fracture in an elderly patient.

## JACO Editorial Summary

1. This paper was written at the Center

for Sports and Exercise Medicine at Queen Mary's University, London

2. The purpose of this paper was to review and identify the factors in stress fractures of the lower extremity including diagnosis and treatment.
3. Review of this article will provide further variables for differential diagnosis regarding patients presenting to a chiropractic office

with the complaint of leg pain.

### **Summary**

Chiropractors who read this article will have a better understanding of the causes of stress fractures of the lower extremities and the most vulnerable populations. Identification of these fractures leads to simple treatment (rest) and generally the full resolution of this disorder.

## Radiology Corner

### Case Presentation: 16 year old female with back pain

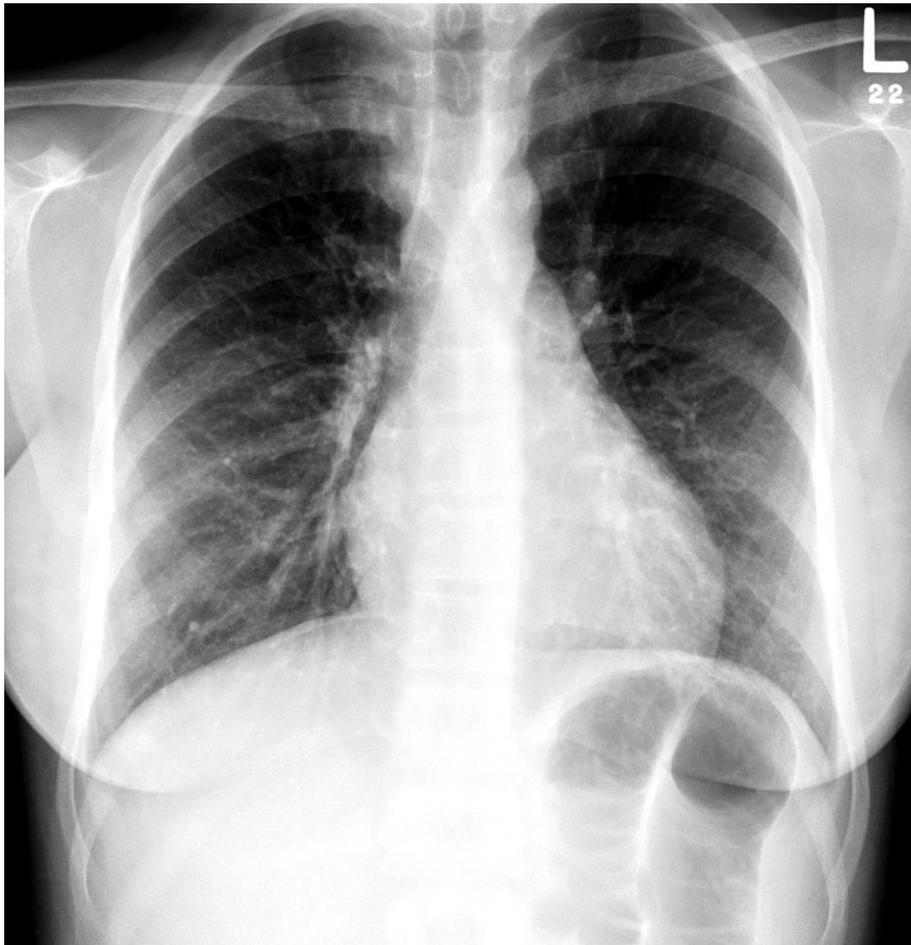
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*Finding:* Generalized osteopenia.

## Discussion:

The purpose of this case presentation of generalized osteopenia is not solely for radiologic diagnostic acumen, but to highlight the importance of good-quality radiographs, and to review a quick method of assessing bone density on an x-ray that may not be commonly performed.

Anton<sup>1</sup> suggested measuring the upper cortex of the mid-clavicle on chest radiographs as a means of diagnosing osteoporosis. He states at less than 1.5 mm it is indicative of osteoporosis, while a smaller incidence is associated with readings of 2 mm and above.

This evaluation is not limited to the chest x-ray, if proper adjustments are made to account for radiographic positioning – for example, on a frontal lower cervical or thoracic spine radiograph. If there is overexposure, and/or poor resolution in a digital x-ray system, this may create a false-positive finding. Dr. Donald Resnick, a renowned musculoskeletal radiologist has said, "You can take a normal patient and an abnormal X-ray technician, and give the patient osteoporosis at will." An appropriately-exposed radiograph with quality equipment (especially with digital x-ray systems), is imperative in the assessment of any radiographic image, but especially so in this case.

Evaluation of the upper clavicle cortex in the chest x-ray<sup>2</sup> above shows marked thinning, less than 1.5 mm. Osteopenia in a 16 year old should raise suspicion, and indeed this patient had high parathyroid levels indicative of hyperparathyroidism. There are no other findings on the chest x-ray. Other radiologic differentials for osteopenia in a young person to consider in the appropriate clinical setting would include non-specific osteomalacia, anemia, and malnutrition (eg, female athlete triad).

To confirm the diagnosis of osteopenia, further testing with dual energy x-ray absorptiometry (DXA or DEXA) or quantitative CT may be performed.

For diagnostic radiology imaging interpretation and expert review of spine and musculoskeletal x-ray, MRI, and CT contact Dr. Cliff Tao at: Email: [dcdacbr@gmail.com](mailto:dcdacbr@gmail.com)  
Ph: [714-876-1126](tel:714-876-1126)

## References:

1. Anton HC. Width of clavicular cortex in osteoporosis. *Br Med J* 1(5641):409-11, 1969.
2. Image provided with permission from Dr. Hani Salam, [Radiopaedia.org](http://radiopaedia.org) (full case can be viewed at: <http://radiopaedia.org/cases/brown-tumour>, accessed 9/1/14).

## Announcements

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### **The Academy of Chiropractic Orthopedists has received the following announcement.**

#### Research Position Available for Spine Surgery Practice

The Steadman Clinic in Vail, Colorado is looking for a full time researcher for the practice of Donald Corenman, M.D., D.C. This individual would work for the Steadman Phillipon Research Institute (SPRI) as a member of the team but devoted only to spine research. Responsibilities would include knowledge of all the spine literature and understanding how to write papers. The ability to organize data along with curiosity, meticulousness and thoroughness is important. Knowledge of direct statistics is not as important as SPRI has an in-house statistician. There are opportunities to teach and present papers at national and international meetings. Full benefits include medical, dental and retirement plan as well as a ski pass.

If you are a chiropractor or researcher who is interested, please send your CV or resume to:  
Donald S. Corenman, M.D., D.C.

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