Case Study

Normalization of Serum Creatinine Levels, Estimated Glomerular Filtration Rate & Dysautonomia Following Chiropractic Care to Reduce Vertebral Subluxation: A Case Report & Review of the Literature

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Abstract

Objective: To report on the positive health outcomes and physiological changes pertaining to kidney function occurring following chiropractic care.

Clinical Feature: 42-year-old male with complaints of neck pain, low back pain and right pelvic pain. Blood analysis showed elevated serum creatinine levels and decreased glomerular filtration rate. Paraspinal thermal scanning demonstrated dysautonomia.

Intervention and Outcome: Low-force, instrument assisted chiropractic care utilizing Torque Release Technique (TRT) aimed at removing vertebral subluxations through the assessment of the spinal-dural-neural unit. Patient reported an improvement in all pain complaints, paraspinal thermography showed reduction in dysautonomia. The patient also experienced a reduction in serum creatinine levels and improved glomerular filtration rate following 6 months of care.

Conclusion: Improvements in the patient's subjective complaints, as well as objective thermography, and blood analysis were seen while receiving chiropractic care. Further research is encouraged to explore the role of chiropractic management in these patients.

Key Words: *Chiropractic, creatinine, glomerular filtration rate, chronic kidney disease, vertebral subluxation, Torque Release Technique (TRT)*

Introduction

Epidemiology

According to The National Kidney Foundation,[1] 1 in 3 adults are at risk for developing kidney disease, such as chronic kidney disease (CKD). The presence of CKD makes a person more at risk for developing other diseases, most severely end stage renal disease (ESRD) and cardiovascular disease.[1-2]

It is estimated that over 26 million Americans currently have or, are at an increased risk for developing chronic kidney disease.[2] The incidence of CKD continues to rise. This can be most drastically in the age group >65 years old. The prevalence rate of CKD (stages 1-4) increased from 10.3% from 1988-1994 to 13.1% in 1999-2004.[2] Similarly, The National Health and Nutrition Examination Survey (NHANES) found the prevalence among adults 60 years or older increased from 18.8% in 1988-1994 to 24.5% in 2003-2006.[3] African Americans are believed to be at a higher risk for developing CKD however, research conducted by Peralta et al[4] suggests that the prevalence between African Americans and whites are similar but that African Americans are more likely to progress to ESRD than whites.

Etiology

Chronic kidney disease is generally recognized as a long term, gradual, and often-irreversible loss of kidney function but a true definition had been debated for years due to various testing methods for measuring kidney function.[5] As defined by the National Kidney Foundation,[1] chronic kidney disease is a decrease in glomerular filtration rate (GFR) <60 mL/min/1.73m^2 or the presence of kidney damage, through lab tests or diagnostic imaging, for more than 3 months. Albuminuria is an indicator of leakage of blood proteins through the kidneys and indicative of kidney damage.[6] Other signs of structural damage include inflammatory processes such as glomerulonephritis or structural changes due to polycystic kidney disease (PKD).[7]

While several risk factors are present for developing CKD, including diabetes, and high blood pressure, symptoms may not be present until the disease progresses to end stage.[1] Diabetes is the number one cause of kidney failure worldwide, as more than 33% of cases is a result of this condition.[7] Other risk factors include old age, obesity, and family history of various renal disorders.[8] It is recommended that those with a family of CKD, PKD, or renal failure receive regular screening (creatinine clearance, GFR) for early detection and prevention of CKD.[1,9] If left unmanaged CKD can result in more serious complications, including kidney failure and cardiovascular disease.[8]

Pathophysiology

It is the job of the kidneys to excrete water-soluble waste products in the form of urine. In doing so the kidneys can help maintain normal volume and chemical composition of body fluids.[9] This is achieved by filtering blood through the kidney nephrons, also known as the functional unit of the kidney. There are estimated to be over a million of these functional units within each kidney and each is made up of two parts. The first is the renal corpuscle, which consists of tiny capillaries, known as the glomerulus.[6,9] This bundle of capillaries consists of an endothelial basement membrane, allowing the glomerulus to filter out blood proteins and other waste products.[10] This glomerulus is then surrounded by a structure known as the Bowman's capsule, which collects blood to be filtered down through the glomerulus.[6,9]

The second part of this functional unit includes the renal tubules. These tubules consist of the distal convoluted tubule, proximal tubule, Loop of Henle, proximal convoluted tubule, and the collecting ducts.[9] It is here where the fluid is either reabsorbed back into the blood, or excreted as waste in the form of urine.[9] One such waste product is creatinine, a chemical byproduct of the breakdown of creatine, a muscle tissue component. The presence of creatine highly correlates to the amount of muscle mass an individual and is constantly being broken down into creatinine.[9,11] Blood flows into the glomerulus via the afferent arteriole. After passing through the nephron and its two components, the filtered blood is then moved through the efferent arteriole and back into systemic circulation.[9]

The two most common causes of CKD include diabetes and systemic hypertension.[1] In the presence of diabetes histological changes take place within the glomerulus and surrounding arterioles. Glomerular basement membrane thickening occurs as well as hyaline thickening of the afferent and efferent arterioles.[9] Thickening of the endothelial basement membrane results in a decrease in GFR as metabolic byproducts, such as creatinine, can no longer filter through resulting in a build in the blood.[9,12]

Hypertension can affect the glomerulus in two ways. An increase in blood pressure within the afferent arteriole subsequently results in decrease in blood flow to the glomerulus and a decrease in GFR.[11,13] Similarly, an increase in blood pressure within the efferent arteriole can result in intraglomerular hypertension and hypertrophy, leading to impairment of the glomerulus and surrounding Bowman's capsule.[13]

Renal blood flow (RBF) and GFR are kept constant by a phenomenon called autoregulation.[9,14] It is through this process that GFR remains constant despite variations in systemic blood pressure. This process helps maintain proper excretion of waste products, such as creatinine, by preventing an increase in intraglomerular pressure, thus providing protection for the functional unit of the kidney.[14]

Creatinine is a compound that is not reabsorbed by the renal tubules and is primarily filtered out by the glomerulus.[9] When renal impairment is present, creatinine is not completely filtered out by the glomerulus and levels begin to rise in the blood, thus providing an outlook of overall kidney function.[8]

Diagnosis

There are several blood analysis tests used to assess kidney function and early detection of kidney disease. One such test is glomerular filtration rate (GFR) and has been regarded as the standard for measuring kidney filtration and overall kidney function.[5,7] Serum creatinine is the standard physiological marker used to detect GFR and often is recommended to estimate kidney filtration and overall kidney function due to its clinical ease and strong association to risk of CKD.[2,5,7]

After a blood sample is taken the serum creatinine levels are then used, along with other factors, to estimate GFR. One such method for estimating GFR is the use of the equation established by the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI).[7,15] This equation uses serum creatinine levels and adjusts according to age, sex and race to determine the estimated glomerular filtration rate (eGFR).[7] The CPK-EPI equation is as follows:

$$GFR = 141 \times \min(S_{cr}/\kappa, 1)^{\alpha} \times \max(S_{cr}/\kappa, 1)^{-1.209} \times 0.993^{Age} \times 1.018\ [\text{if female}] \times 1.159\ [\text{if black}]$$ [16]

This equation was measured against the more popular Modification of Diet in Renal Disease (MDRD) equation and was found to be more accurate while showing a strong correlation between eGFR and actual GFR measurements above 60mL/mg/1.73m^2. [12,15,16]

The National Kidney Foundation reports normal GFR ranges between 90 mL/min/1.73m^2 to 120 mL/min/1.73m^2 [(1)]. CKD can be divided into 5 stages based on the level of serum

creatinine and the eGFR. These stages can be found in the section Tables, under TABLE 1.

Serum creatinine levels also can be used to assess overall kidney function, as this is the primary biological marker used to measure GFR.[5] Abnormal serum creatinine levels alone can be indicative of several kidney disorders, including chronic kidney disease, kidney failure, infection, vascular dysfunction, rhabdomyolysis, and preeclampsia, or eclampsia in pregnant women. The test is conducted similar to the GFR test with the withdrawal of a blood sample. Normal values for men range from 0.7 mg/dL to 1.3 mg/dL, and 0.6 mg/dL to 1.1 mg/dL for women due to their decrease in muscle mass.[17]

The purpose of this paper is to highlight the possibility that chiropractic care may be an effective part of the management for a patient presenting with abnormal kidney function.

Case Report

History

A 42-year-old male patient presented to a chiropractic office. His initial reasons for care included low back, right-sided neck, and right pelvis pain. He reported that the low back and pelvis pain have been present for almost 30 years when he suffered injuries playing competitive high school football. The neck pain began decades ago from trauma that the patient sustained from playing a pick-up game of playground football.

Each of his pain locations were rated as a 7, on a scale of 0 to 10 with 10 being the worst pain the patient has ever experienced. He reported noticing the pain approximately 70% of the time. The patient also reported he periodically experienced numbness in his right arm into his right 5th digit, as well as right shoulder pain. However, no subjective or objective findings were noted on these complaints.

The patient was currently taking Lisinopril and Bisoprolol to help manage his high blood pressure, and Crestor for high cholesterol levels. In 2011 he underwent catheterization surgery and another surgery in 2012 to repair a deviated septum. Prior to seeking chiropractic care, the patient had sought the care of medical doctors for his back and neck pain, with minimal to no improvements reported. This is his first time seeking chiropractic services.

Examination

An initial chiropractic examination of the patient was conducted, including thermal scanning of the paraspinal musculature. The first initial scan showed several areas of asymmetry including mild variations at C2, C3 on the right and T12 on the left, as well as a moderate variation of C7 and T1 on the left. These variations are representative abnormalities within the sympathetic nervous system.[18] Complete thermography readings can be found under the figures section, Figure 1.

Diagnostic Lab Values

The patient had previously received a blood analysis in September of 2014, which revealed borderline abnormal kidney function. Medical records for these lab tests revealed elevated serum creatinine levels with a value of 1.41 mg/dL. This value was then applied to the CKD-EPI equation[16] and an eGFR of 60 mL/min/1.73m^2 was recorded. According to the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (K/DOQI), the patient is classified as Stage 2 (60-89 mL/min/1.73^2) chronic kidney disease, with kidney damage and mildly decreased GFR.[1,12] The patient's blood analysis can be found under the figures section, Figure 2.

Intervention

Following the history and chiropractic examination the patient was placed on an initial care plan of 60 visits over the course of 12 months. The visits were broken down into 3 visits per week for 4 weeks followed by 2 visits a week for 12 weeks, 1 visit a week for 16 weeks, and 2 visits a month for 4 months. The patient received a specific, low-force, tonal therapy using the Torque Release Technique (TRT). This technique addresses the entire spinal-dural-neural unit also known as a Cranial-Spinal Meningeal Functional Unit (C-SMFU), comprised of the brain, spinal cord, multi-layered meningeal sheath, cranial bones, vertebral column, and pelvis.[19]

By addressing this unit, the TRT protocol can address the whole body as a system and to identify patterns of subluxation. This is done through a scan in which thirteen different parameters are addressed to identify interferences within this spinal-neural system.[18] These parameters consist of visualization, static palpation, motion palpation, pressure tests, and heel-tension.[20]

Functional leg length inequality (FLLI) was used to assess the patient for subluxations. FLLI differs from other leg length analysis (LLA) in that it stretches the deep tendon reflexes (DTR) of the Achilles tendon with short compressive impulses to the dorsum of the foot and calcaneus. Exact leveling of the legs using the FLLI is desired following each specific adjustment as this denotes neural adaptation is taking place.[20] It is believed that by performing a functional leg check the clinician obtains better information regarding physiological changes anywhere within the body system through abnormal biomechanics.[21] These abnormalities, which are important to the many models of vertebral subluxation,[22] include muscle asymmetry and bony misalignments.[21] The FDA approved Integrator,[19] a hand held adjusting instrument, was utilized for each adjustment.

Each visit the patient was in the prone position and the protocol in which the 13 parameters are assessed was performed. Each parameter is assessed in order and following each adjustment to the order is repeated from the beginning. Once three adjustments have been made, the adjustment is complete for that visit. This is based on the belief that only one subluxation is present at any given time and correcting more than three in one visit provides too much neurological stimuli for the patient.[19,20]

Observation for postural faults or abnormal breathing patterns is first assessed. This is followed by palpation of the entire C-SMFU, checking for tone and temperature asymmetry. Motion palpation, static palpation, and stress tests were then applied to assess both ends of the spinal-dural-neural unit. This included

lateral sacrum/lateral occiput or lateral coccyx/sphenoid, also known as priority one.[23] After assessing this area the doctor moved on to check for priority two consisting of Cervical Syndrome of C1 or C5, Bilateral Cervical Syndrome, or Wrong-un[23] which represents a unique atlas subluxation.[20] Priority three involves performing the Derifield leg checks to assess for +Derifield. Palpation and stress test compromise the next five priorities which involve various segments, including C2, C7, L3, L5, and the thoracic spine.[23]

Thermal scanning using the Insight Subluxation Station was conducted to measure autonomic nervous system function which demonstrated dysautonomia. It is theorized that paraspinal skin temperature variations are due to changes in the diameter of the arterioles of the spinal and paraspinal musculature thus providing insight into the state of the autonomic nervous system.[18,24,25] The Insight Rolling Thermal Scan uses thermal couple sensors to detect slight variations in skin temperature.[18] The Council of Chiropractic Practice (CCP), as well as the International Chiropractic Association (ICA) recognizes instruments using thermal couple sensors as a viable chiropractic tool for assessing paraspinal skin temperature and its relation to vertebral subluxation.[26,27]

Furthermore, the Insight Thermal Scanner has been proven to be a reliable method for measuring physiological changes within the body due to its remarkably high intra-examiner and inter-examiner reproducibility.[28]

Outcomes

On the first visit the patient was checked using the TRT protocol and adjustments to the right occiput and left atlas were administered. Over the next three visits adjustments were given to subluxations of the right occiput, right sacrum, coccyx/sphenoid, right C1, and right C5. During the course of his 12 months of care the patient received the majority of his adjustments to the upper cervical spine, C1 and occiput. The patient self-reported feeling 30% improvement in his chief complaints following the first adjustment and 70% improvement within the first month.

Subsequent neuro scans conducted on the 20th visit showed a reduction of asymmetry in each of the previous areas with mild asymmetry of T2 on the left and T11, T12 on the right. Following another 22 visits the patient was scanned again and continued to show improvement in thermal symmetry in all areas with only a mild asymmetry present at L4 on the left. The patient's fourth and final scan came on his 60th visit and with significant improvement paraspinal symmetry with no significant asymmetries present indicating reduction in dysautonomia.

Another serum creatinine analysis was performed following chiropractic care with a result of 1.19 mg/dL, well within the normal range for males.[12] When this value was applied to the CDK-EPI equation to estimate GFR a value of 101 mL/min/1.73^2 was observed. This value is above the average for eGFR for males in his age group[2] (See Table 2) as well as no longer classified as CKD according to the K/DOQI classification.[12]

As of writing this paper, the patient is continuing to be seen about 2 times a month, using the TRT protocol and adjustment.

Discussion

Complementary Alternative Management

Chronic kidney disease is a disease that affects more than 26 million Americans and continues to rise as obesity, diabetes, and cardiovascular rates rise.[2] With better methods for estimating overall kidney function, early detection of chronic kidney disease is readily achievable.[15,16] If detected early the disease progression can be slowed or stopped with conservative treatment.[13] While the chiropractic literature is lacking regarding the possible effectiveness of chiropractic care on kidney function.

The focus of the remaining conservative management revolves around the control of blood pressure and blood glucose levels, as these are the two main causes of CKD.[1,7,13] The most common method in which this is accomplished is through dietary modifications of sodium and glucose. Lifestyle changes such as the cessation of smoking can have a profound impact on the progression of CKD due to the vasoconstrictive properties smoking has on the blood vessels.[12]

Allopathic Management

The current allopathic model for the treatment of CKD revolves around the same concept of managing blood pressure to help slow or prevent the progression of the disease. This is first done through the administration of blood pressure medication, most commonly renin-angiotensin compounds.[12]

One down fall of this treatment is that when CKD symptoms and diagnostic findings improve, blood pressure medication must continue due to the likelihood of hypertension returning once medication is ceased. Patients should aim to maintain a systolic blood pressure of <120mm Hg but the effects on kidney function are still unknown. As the disease progresses, further treatment involves dialysis for late stage renal failure or kidney transplantation.[12]

Proposed Mechanisms

Due to the history of trauma to the neck and low back suffered by this patient, it can be theorized that improper juxtaposition of the vertebral segments of the spine developed. This juxtaposition, of one vertebral segment in relation to another, can result in improper intervertebral motion.[22] Within the intervertebral segments and articular segments lie a significant number of mechanoreceptors, proprioceptors and nociceptors.[29] Sampath[30] states; "A significant factor that underpins the neurophysiological model is the interaction between the nociceptive (pain) system and the ANS." This is mainly manifested through the sympathetic nervous system (SNS).[30]

The patient exhibited a chronic subluxation pattern of the C1 vertebral segment as this segment was adjusted 15 times before the first reassessment (20 visits) and a total of 48 times throughout the course of his care plan. It is therefore reasonable to consider that chronic stress to the nociceptive

fibers has resulted in altered afferent input into the central nervous system (CNS), otherwise known as dysafferentation.[22,31] It is further proposed that by correcting this juxtaposition and restoring normal spinal biomechanics, afferent input into the CNS improves along with perceived health benefits.[31]

An increase in SNS activity has known physiological effects on the body, including vasoconstriction of the smooth muscles within the blood vessels.[25,30,32] The afferent arterioles, as well as, the efferent arterioles of the glomerulus are highly innervated with sympathetic nerve fibers.[9] Thus, chronic SNS activation can result in vasoconstriction of these blood vessels and a resultant increase in blood pressure.[25,30,32]

Vasoconstriction of the afferent arterioles results in decrease blood flow to the glomerulus, resulting in a decrease in GFR and an increase in metabolic waste products, such as creatinine, in the blood.[8,12,14] Similarly, vasoconstriction of the efferent arterioles, results in an increase in intraglomerular pressure and further damage to the endothelial cell membrane and hypertrophy of the glomerulus again leading to a decrease in GFR subsequently increasing blood protein levels.[9,12]

Kent et al proposes that sudden stretching of the joint capsule, as which occurs with a chiropractic adjustment, has an effect on mechanoreceptors thereby inhibiting the pain level.[22] This, even temporarily, reduces SNS stimulation resulting in relaxation of the smooth muscles of the afferent and efferent arterioles and vasodilation of the blood vessel lumen; reducing blood pressure and improving renal blood flow into the glomerulus.[9,12,25,32]

Conclusion

Due to the rise of diabetes, hypertension, and obesity the prevalence of renal disorders, including chronic kidney disease continues to increase.[2] It is widely accepted that proper preventative measures, both from conservative and allopathic models, stems from maintaining or reducing blood pressure and blood glucose levels.[1,7,12,13] With surgical intervention or invasive hemodialysis recommended if conservative methods do not work. In this case, chiropractic care may have played a role in the physiological changes that resulted in the reduction of serum creatinine levels, by restoring balance to the autonomic nervous system.[31]

However, due to the small sample size of this case and the lack of confounding research regarding chiropractic care and kidney function, further research needs to be conducted. This research should include larger sample sizes and be performed over a longer period of time, taking into account all confounding variables. Research should be centered on the removal of vertebral subluxation to provide for a clearer insight on its role in managing patients with chronic renal disorders.

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Appendix

Stage	Description	GFR (mL/min/1.73^2
1	Kidney damage with normal or increased GFR	>90
2	Kidney damage with mildly decreased GFr	60-89
3	Moderately decreased GFR	30-59
4	Severely decreased GFR	15-29
5	Kidney failure	<15 (dialysis)

Table 1. National Kidney Foundation's Kidney Disease Outcome Quality Initiative (K/DOQI) Classification of chronic kidney disease (CKD)[12]

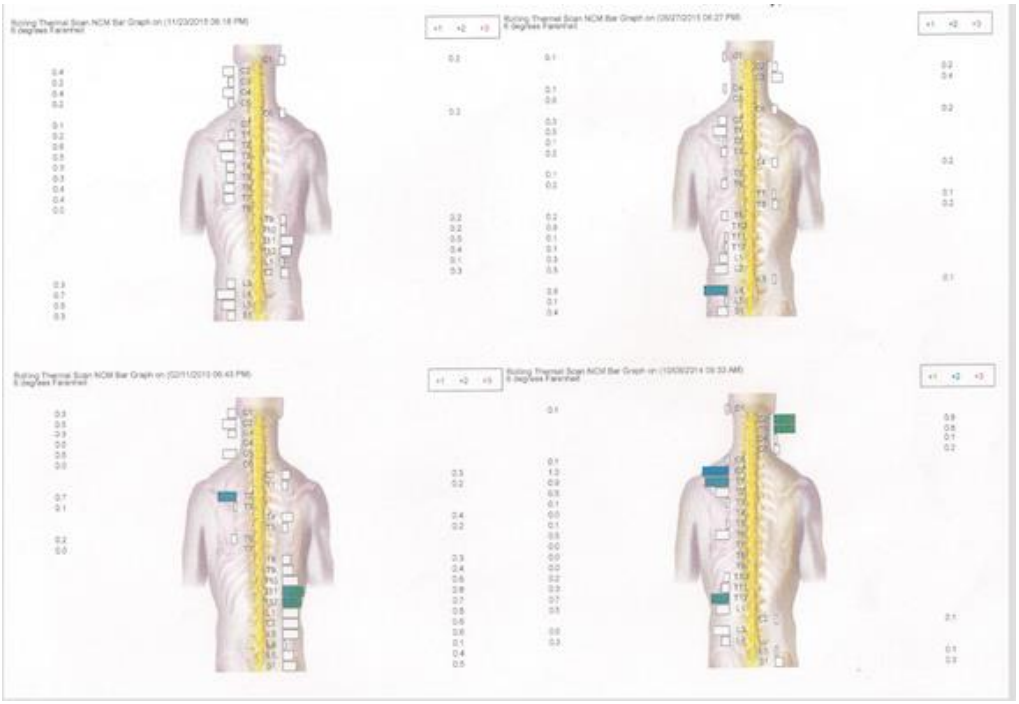

Figure 1. Patient Insight Thermography scans from initial examination (bottom right), 1st reassessment (bottom left), 2nd reassessment (upper right), and 3rd reassessment (upper left).

Figure 2. Patient serum creatinine lab values