Tendon Ultrasonographic Alterations in Patients on Regular Hemodialysis

Thesis

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Introduction

End stage renal disease is associated with increased prevalence of physical inactivity, reduced exercise capacity and different grades of disability ***(Cupisti et al., 2011).*** Implementation of physical activity both during and out of the dialysis session is warranted and useful to enhance quality of life and physical performance, and to reduce the risk of mortality and hospitalization ***(Elder et al., 2005).***

Renal osteodystrophy (ROD) has been described in patients with chronic kidney disease (CKD). Emphasis has been given to secondary hyperparathyroidism, osteomalacia and osteoporosis, adynamic bone disease and soft-tissue or vascular calcifications. Less common musculoskeletal manifestations include aluminum, amyloid and/ or crystal deposition, destructive spondyloarthropathy, avascular necrosis and tendon ruptures ***(Bardin et al., 2003)***.

In particular, spontaneous ruptures of the quadriceps and/or the Achilles tendon in CKD patients with secondary hyperparathyroidism have been sporadically reported and are usually regarded as isolated events. Literature data regarding the etiology are controversial, and the predisposing factors behind such ruptures still remain unknown. Some authors speculate that the tendon remains intact and the cause of rupture

is an osteolytic bone resorption at the tendon insertion site, caused by secondary hyperparathyroidism and parathormone (PTH) excess ***(Chen et al., 2006)***.

Although magnetic resonance imaging remains one of the main diagnostic imaging modalities for evaluating joint pathology worldwide, there are a number of useful applications and advantages of diagnostic ultrasound in the assessment of musculoskeletal pathology. Ultrasonography (U/S) may be used to assess superficial tendons and ligaments that traverse a joint. It can demonstrate the presence and characteristics of joint effusions, bursae, or cysts, and it also can detect loose bodies in joints. The advantages lie in the cost-efficiency, shorter examination time, and the ability for real-time and dynamic imaging. Its portability allows one to perform imaging of the anatomic structure in question and to perform rapid side-to-side comparisons. ***(Chew et al., 2008)***.

Aim of the Work

To investigate the frequency and nature of the Achilles and Quadriceps tendons involvement in patients with renal failure undergoing regular hemodialysis in the relationship to the levels of parathyroid hormone (PTH), using ultrasonographic evaluation.

Chronic Kidney Disease

Definitions and classification:

The definition and classification of chronic kidney disease may help identify affected patients, possibly resulting in the early institution of effective therapy. To achieve this goal, guidelines were proposed from the National Kidney Foundation of the United States through its Kidney Disease Outcomes Quality Initiative (K/DOQI) program K/DOQI clinical practice guidelines for chronic kidney disease:. These guidelines have been reviewed and accepted internationally ***(Levin et al., 2008)***.

The K/DOQI working group defined chronic kidney disease in adults as: evidence of structural or functional kidney abnormalities (abnormal urineanalysis, imaging studies or histology) that persist for at least three months, with or without a decreased GFR (as defined by a GFR of less than 60 ml/minute per 1.73 m^2). The most common manifestation of kidney damage is persistent albuminuria, including microalbuminuria or decreased GFR, with or without evidence of kidney damage ***(Levey et al., 2005)***.

Based upon these definitions, the following is the recommended classification of chronic kidney disease by stage and the estimated prevalence within the United States of each

stage, as determined by a National Health and Nutrition Examination Survey (NHANES) performed in 1999 to 2004:

Table (1): Classification of chronic kidney disease by stages:

Stage 1	Disease is defined by a normal GFR (greater than 90 mL/min per 1.73 m^2) and persistent albuminuria (1.8 percent of the total United States population)
Stage 2	Disease is a GFR between 60 to 89 mL/min per 1.73 m^2 and persistent albuminuria (3.2 percent)
Stage 3	Disease is a GFR between 30 and 59 mL/min per 1.73 m^2 (7.7 percent)
Stage 4	Disease is a GFR between 15 and 29 mL/min per 1.73 m^2 (0.21 percent)
Stage 5	Disease is a GFR of less than 15 mL/min per 1.73 m^2 or end-stage renal disease (2.4 percent for stages 5).

(Coresh et al., 2003)

Epidemiology:

Chronic kidney disease affects a large proportion of older adults, and the prevalence of chronic kidney disease has been increasing over the last two decades. Established risk factors for chronic kidney disease include age, gender, blood pressure, smoking, and diabetes. An increase in obesity, diabetes, and hypertension accounts for some of the increased prevalence of chronic kidney disease, but the epidemiological risk factors for chronic kidney disease are incompletely explained ***(Coresh, 2007)***.

Progressive renal disease occurs in all age groups. The incidence of CKD among patients less than 16 years of age varies between 1.5 and 3 per million. The incidence of ESRD in patients is 20 per million populations ***(Locatelli et al., 2002)***.

Causes:

The cause of chronic kidney disease is not always known. But any condition or disease that damages blood vessels or other structures in the kidneys can lead to kidney disease ***(Levey et al., 2003)***.

The most common causes of chronic kidney disease are:

(1) Hypertension:

High blood pressure (hypertension) causes another 30% of all kidney disease. Because blood pressure often rises with chronic kidney disease, high blood pressure may further damage kidney function even when another medical condition initially caused the disease. High blood pressure is the most common cause of chronic kidney disease that leads to end stage renal disease (ESRD). High blood pressure may also speed up the progression of chronic kidney disease in someone who already has the disease ***(Levey et al., 2003)***.

(2) Diabetes:

High blood sugar levels causing damage of blood vessels in the kidneys. If the blood sugar level remains high, this damage gradually occurs and reduces the function of the kidneys. Diabetes causes about 35% of all chronic kidney disease ***(Levey et al., 2003)***.

(3) Kidney diseases and infections:

Such as pyelonephritis, glomerulonephritis, polycystic kidney disease or a kidney problem since birth as narrowed or blocked renal artery ***(Yu, 2003)***.

(4) Drug induced nephrotoxicity:

- NSAIDs: the most common NSAIDs associated with nephrotoxicity are Ketorolac and Indomethacin.
- Antimicrobials like aminoglycosides (occurs in 10-20% patients on 7 day course and results in non-oliguric increased Creatinine), quinolones (e.g., Ciprofloxacin, Levofloxacin), Rifampin, Tetracycline, Vancomycin, Amphotericin B (incidence 80-90%, especially with deoxycholic acid formulation), Foscarnet, Acyclovir (only nephrotoxic in intravenous form) and Pentamidine.

- Chemotherapy and Immunosuppressants like Cisplatin, Methotrexate, Mitomycin, Cyclosporine and Ifosphamide.

- Other drugs

    1. Radiographic contrast (contrast nephropathy).

    2. Heavy Metals like Mercury poisoning, Lead poisoning, Arsenic poisoning, Bismuth and Lithium.

    3. Drug abuse: Cocaine, Heroin, Methamphetamine and Methadone.

    4. Chinese herbals containing aristocholic acid ***(Scott, 2012)***.

(5) Autoimmune causes of CKD:

a) Systemic lupus erythematosus (lupus nephritis):

Renal involvement is common in SLE, an abnormal urine analysis with or without elevated plasma creatinine concentration is present in a large proportion of patients at the time of diagnosis, and may eventually develop in up to 75 percent of cases. The most frequently observed abnormality is proteinuria. There are a number of types of renal disease in SLE, usually differentiated with a renal biopsy, with immune complex-mediated glomerular diseases being most common ***(Kelley and Saurders, 2000)***.

b) Systemic vasculitis:

Renal involvement is common in any of the forms of systemic vasculitis. These include classic polyarteritis nodosa, Wegener's granulomatosis, microscopic poly-arteritis, Churg-Strauss syndrome, and the hyper-sensitivity vasculitides ***(Savage, 2001)***.

c) Mixed Cryoglobulinemia:

Glomerular disease may occur in those patients. The most common patterns are membranoproliferative glomerulonephritis ***(McGuire et al., 2006)***.

d) Sjögren's syndrome:

The interstitial nephritis in Sjögren's syndrome is characterized histologically by an interstitial infiltrate that can invade and damage the tubules. Glomerular involvement is much less common than interstitial nephritis in Sjögren's syndrome. Membranoproliferative glomerulonephritis and mem-branous nephropathy are the most common ***(Kim et al., 2008)***.

The pathogenesis of the glomerular disease, including the possible etiologic relationship to Sjögren's syndrome, is unclear, but may be related to the deposition of circulating immune complexes ***(Goules et al., 2000)***.

e) IgA nephropathy:

IgA nephropathy is the most common lesion found to cause primary glomerulonephritis ***(D'Amico, 2004)***. The initiating event in the pathogenesis of IgA nephropathy is the mesangial deposition of IgA, which is predominantly polymeric IgA of the IgA1 subclass (polymeric IgA1-containing J chain). Codeposits of IgG and complement (C3 but usually not C1q) are also commonly seen and may contribute to disease severity. Mesangial deposition of secretory IgA has also been reported, but the pathogenic significance of this is unclear ***(Oortwijn et al., 2007)***.

Patients with IgA nephropathy typically present in one of three ways:

- Approximately 40 to 50 percent present with one or recurrent episodes of gross hematuria, usually following an upper respiratory infection.

- Another 30 to 40 percent have microscopic hematuria and usually mild proteinuria, and are incidentally detected on a routine examination.

- Less than 10 percent present with either nephrotic syndrome or acute rapidly progressive glomerulonephritis picture characterized by edema,

hypertension, and renal insufficiency as well as hematuria ***(Donadio and Grande, 2002)***.

f) Antiphospholipid Syndrome:

The kidney is one of the organs that can be compromised in patients with Antiphospholipid antibodies. Renal complications directly resulting from thrombotic events associated with these antibodies include glomerular disease, large vessel renal involvement and coagulation problems related to dialysis and renal transplants ***(Joseph et al., 2001)***.

Diagnosis:

A-Clinical picture:

1. General manifestations:

Volume overload:

Sodium and intravascular volume balance are usually maintained via homeostatic mechanisms until the GFR falls below 10 to 15 ml/minute. However, the patient with mild to moderate chronic kidney disease, despite being in relative volume balance, is less able to respond to rapid infusions of sodium and is therefore prone to fluid overload, patients with chronic kidney disease and volume overload may present by eye puffiness, lower limb odema or pulmonary odema and they generally respond to the combination of dietary sodium

restriction and diuretic therapy, usually with a loop diuretic given daily, some investigators have also claimed that limiting sodium intake may also help decrease progression of chronic kidney disease by lowering intraglomerular pressure ***(Weir and Fink, 2005)***.

Malnutrition:

Malnutrition is common in patients with advanced chronic renal disease because of a lower food intake principally due to anorexia, decreased intestinal absorption and digestion and metabolic acidosis. Patients are malnourished if they demonstrated at least three of the following five criteria: serum albumin ≤ 37 g/L, male weight ≤ 63.9 kg, female weight ≤ 51.8 kg, serum cholesterol < 4.1 mmol/L, energy intake < 15 kcal/kg/day and protein intake < 0.5 gm/kg/day ***(Bammens et al., 2003)***.

Anemic manifestations:

Nearly 90% of patients with a GFR less than 25 to 30 mL/min have anemia, many with Hb levels below 10 gm/dl. It is associated with an increased risk of morbidity and mortality principally due to cardiac disease and stroke. Anemia has also been implicated as a contributing factor in many of the symptoms associated with reduced kidney function, these include fatigue, depression, reduced exercise tolerance, dyspnea and cardiovascular consequences, such as LVH, left