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Caso clínico

## **Osteoarthritis in type II diabetes mellitus, imaging approach. Number of cases**

Osteoartrosis en diabetes mellitus tipo II, enfoque imagenológico. Serie de casos

Osteoartrose no diabetes mellitus tipo II, abordagem por imagem. Case Series

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### **ABSTRACT**

**Introduction:** chronic non-communicable diseases such as diabetes mellitus have increased due to the increasing age of the population and the high prevalence of unhealthy lifestyles such as smoking, physical inactivity and poor dietary habits. Recently studies confirm that diabetes mellitus stimulates the early appearance of osteoarthritis in the body, also in the spinal column, leading to central canal stenosis; Low back pain is a frequent cause of a visit to the doctor.

**Case presentation:** three patients with a long history of diabetes mellitus suffering from long-term low back pain to show the usefulness of imaging, nerve conduction, and laboratory tests as a tool in the differential diagnosis between osteoarthritis and noncompressive neuropathies. All cases have the lumbosacral region affected by osteoarthritis, especially by facet hypertrophy.

**Discussion:** The symptoms and signs in our studied patients are caused by low back pain, cramps and numbness. All three patients had a history of type 2 diabetes mellitus and were obese or overweight. Individually, the older patient had good glycemic control based on the European Diabetes Guide, the younger patient had poor glycemic control, and one of them had associated chronic kidney disease.

**Conclusions:** lumbar osteoarthritis with canal stenosis is a common cause of low back pain in our patients due to hypertrophy of the facet joint; therefore, we recommend imaging, nerve conduction, and physical examination as useful tools in the differential diagnosis between lumbar osteoarthritis and neuropathies due to type 2 diabetes mellitus. We suggest doing extensive research on the sign of early osteoarthritis in patients with diabetes mellitus in our facilities to increase the knowledge of this entity.

**Key words:** Type 2 Diabetes Mellitus; Osteoarthritis; Diagnostic imaging.

## **RESUMEN**

**Introducción:** las enfermedades crónicas no trasmisibles como la diabetes mellitus se han incrementado debido al incremento de edad de la población y la alta prevalencia de estilos de vida no saludables como el hábito de fumar, inactividad física y pobres hábitos dietéticos. Recientemente estudios confirman que la diabetes mellitus estimula la temprana aparición de osteoartrosis en el cuerpo, también en la columna vertebral, liderando la estenosis del canal central; el dolor lumbar es una causa frecuente de visita al médico.

**Presentación de casos:** tres pacientes con larga historia de diabetes mellitus que sufren dolor lumbar de larga data para mostrar la utilidad de las imágenes, la conducción nerviosa y las pruebas de laboratorio como herramienta en el diagnóstico diferencial entre osteoartritis y neuropatías no compresivas. Todos los casos tienen afectada la región lumbosacra por osteoartrosis, especialmente por hipertrofia facetaria.

**Discusión:** los síntomas y signos en nuestros pacientes estudiados son causados por dolor lumbar, calambres y entumecimiento. Los tres pacientes tenían antecedentes de diabetes mellitus tipo 2 y obesidad o sobrepeso. Individualmente, el paciente de más edad tenía un buen

control glucémico basado en la Guía Europea de Diabetes, el paciente más joven tenía un control glucémico deficiente y uno de ellos tenía una enfermedad renal crónica asociada.

**Conclusiones:** la osteoartritis lumbar con estenosis del canal es una causa común de dolor lumbar en nuestros pacientes debido a la hipertrofia de la articulación facetaria; por lo tanto, recomendamos la imagen, la conducción nerviosa y el examen físico como herramientas útiles en el diagnóstico diferencial entre la osteoartritis lumbar y las neuropatías debidas a la diabetes mellitus tipo 2. Sugerimos hacer una amplia investigación sobre el signo de osteoartritis temprana en pacientes con diabetes mellitus en nuestras instalaciones para aumentar el conocimiento de esta entidad.

**Palabras clave:** Diabetes Mellitus Tipo 2; Osteoartritis; Diagnóstico por imagen.

## **RESUMO**

**Introdução:** as doenças crônicas não transmissíveis, como o diabetes mellitus, aumentaram devido ao aumento da idade da população e à alta prevalência de estilos de vida não saudáveis, como tabagismo, inatividade física e maus hábitos alimentares. Recentemente, estudos confirmam que o diabetes mellitus estimula o aparecimento precoce de osteoartrite no corpo, também na coluna vertebral, levando à estenose do canal central; A dor lombar é uma causa frequente de uma visita ao médico.

**Apresentação do caso:** três pacientes com uma longa história de diabetes mellitus com dor lombar a longo prazo para mostrar a utilidade da imagem, condução nervosa e exames laboratoriais como uma ferramenta no diagnóstico diferencial entre osteoartrite e neuropatias não compressivas. Todos os casos têm a região lombossacra afetada por osteoartrite, principalmente por hipertrofia faceta.

**Discussão:** Os sintomas e sinais nos pacientes estudados são causados por lombalgia, câibras e dormência. Todos os três pacientes tinham histórico de diabetes mellitus tipo 2 e eram obesos ou com sobrepeso. Individualmente, o paciente mais velho tinha um bom controle glicêmico com base no European Diabetes Guide, o paciente mais jovem tinha um controle glicêmico ruim e um deles apresentava doença renal crônica associada.

**Conclusões:** a osteoartrite lombar com estenose do canal é uma causa comum de lombalgia em nossos pacientes devido à hipertrofia da articulação facetária; portanto, recomendamos imagens, condução nervosa e exame físico como ferramentas úteis no diagnóstico diferencial entre osteoartrite lombar e neuropatias devido ao diabetes mellitus tipo 2. Sugerimos fazer uma extensa pesquisa sobre o sinal de osteoartrite precoce em pacientes com diabetes mellitus em nossas instalações para aumentar o conhecimento dessa entidade.

**Palavras-chave:** Diabetes Mellitus Tipo 2; Osteoartrite; Diagnóstico por imagem.

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## Introduction

The life expectancy in Qatar is 80 years old. Till July 2017, less than 2% of the population was 65 years old or more; however, Qatar is undergoing tendency of population aging like other developing countries. The prevalence across the world of people with multiple chronic conditions is increasing. This is due partly to the increasing age of the population, and to the high prevalence of unhealthy lifestyle choices such as smoking, physical inactivity and poor dietary habits causing non-communicable diseases. Chronic diseases such as heart disease, cancer and diabetes have all shared risk factors and lifestyle habits that increase a person's chances of developing more than one of these conditions. <sup>(1,2)</sup>

Pain is an unpleasant, subjective sensory and emotional experience. Unlike nociceptive pain, neuropathic pain is caused by dysfunction of the peripheral or central nervous system, and does not require any receptor stimulation, some theories suggested that spontaneous ectopic impulse generation in small-diameter regenerative sprouts could be the cause of neuropathic pain. It is increasingly apparent that the insult of diabetes affects all levels of the nervous system, from the peripheral nerve to the brain. <sup>(3)</sup>

Subacute onset of severe proximal leg and hip pain involving iliopsoas, quadriceps, hip abductors, and adductors are common symptoms for neuropathies. Diabetes mellitus is the most common cause of peripheral neuropathy and distal sensory neuropathy. Clinical diagnosis and investigations are performed mainly to exclude other causes. <sup>(4)</sup>

Diabetic radiculoplexus neuropathy, diabetic amyotrophy or diabetic polyradiculoneuropathy, typically involves the lumbosacral plexus. The complication occurs mostly in men with type 2 diabetes. People with the condition routinely present with extreme unilateral thigh pain and weight loss, followed by motor weakness. Electrophysiological assessment is required to document the extent of disease and alternative etiologies, including degenerative disc disease or neoplastic, infectious, and inflammatory spinal disease, the disorder is usually self-limiting, and patients improve over time with medical management and physical therapy. <sup>(5)</sup>

The MRI technique uses the magnetic field and gradients to induce radiofrequency on the hydrogen atom, later received by coils, and transformed to image using a powerful computers and software; it is very sensitive to assess the soft tissues and bone marrow; and for this reason, it is widely used in nerve, neurologic and medullary disease. It is also used in radiculopathies to rule out compressive cause. <sup>(6,7)</sup>

Diabetes causes skeletal changes that are more likely in patients with diabetes than in patients without diabetes. Prolonged and frequent complications of diabetes include diabetic neuropathy, with symptoms such as pain and sensory and motor deficits in the legs; lumbar stenosis is caused by vertebral space reduction, which can be due to new bone formation or hypertrophic tissue changes; the process usually begins with water loss or reduction in water content, followed by hard disk protrusion into the fiber loop; in other words, changes in the intervertebral disk play a primary role in the pathophysiology of lumbar canal stenosis. Age-related changes in the cartilage matrix in patients with diabetes are different from the changes in healthy subjects; these changes may lead to faster disk degeneration in patients with diabetes. <sup>(8-10)</sup>

Based on this knowledge, we bring a series of patients with history of type 2 diabetes with lumbar pain history to show the importance of imaging in the differential diagnosis among lumbar osteoarthritis and neuropathies due to diabetes mellitus type 2.

## Cases presentation

### Case number 1

She is a 60-year-old Qatari female patient with history of diabetes mellites type 2 for 16 years; she is obese (BMI 48.49Kg/m<sup>2</sup>) with history of chronic lumbar pain, numbness and cramp on both legs, as well chronic diabetic nephropathy.

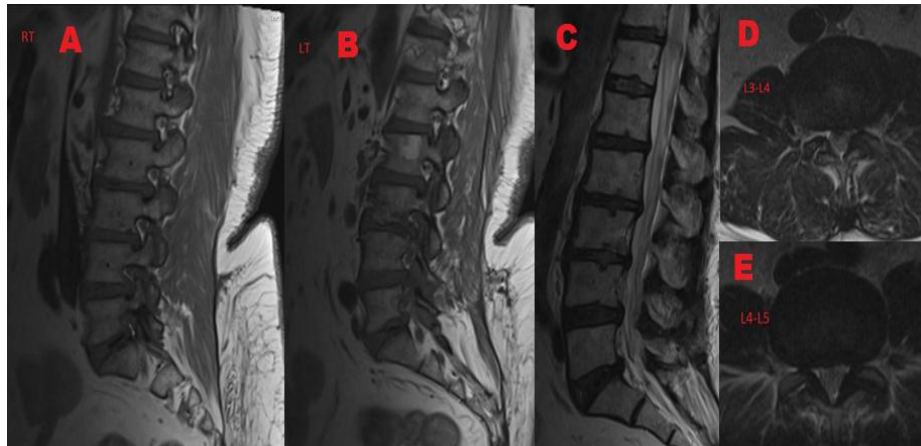
Physical exam with limit of motion on both legs, pain after palpation in the paravertebral soft tissue from L1-L2 to L5-S1 levels, no fibrillation, no weakness on the lower limb muscles, no neurologic bladder dysfunction or bowel dysfunction, deep reflex normal, straight leg raising test was negative.

The lab test result showed during the last three months: glycemia control 6.4 mmol/L, 5.1 mmol/L, 8.2 mmol/L, 8.6 mmol/L, it is controlled under European Diabetes Guidelines, creatinine value of 250Mmol/L.

MRI of the lumbar spine was performed showing lumbar osteoarthritis with degenerative thickening of vertebral bodies and marginal osteophytes, Schmorl nodules in lumbar vertebral bodies, facet joint hypertrophy from L1-L2 to L5-S1 contracting the dural pouch, thickening of cauda equina nerve root, annular protrusion of disk from L1-L2 to L5-S1 contacting the dural pouch, narrowing of the central canal and neural foramens from L1-L2 to L5-S1. (Fig 1)

Nerve conduction was performed as complementary test with reported motor nerve conduction, altered medial nerve on the right and left sides; ulnar nerve on the right and left sides; and also peroneal nerve. Sensory nerve conduction is also altered in the medial nerve on both sides, and no response in sural nerve, probably due to edema, that means axonal sensorimotor neuropathy secondary to diabetes as per neurologist.

The orthopedist prescribes physiotherapy and kept good metabolic control with endocrinologist follow up. She is now under physiotherapy treatment, and the patient referred, in the lasted orthopedist visit, improvement of symptoms.



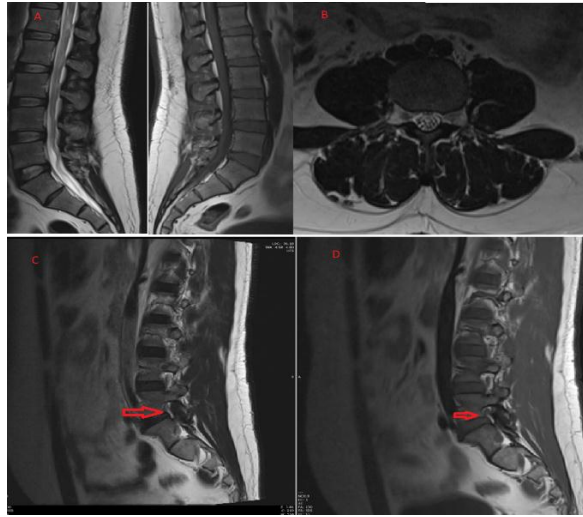
**Fig 1.** T2 sag sequence image “A and B” showed narrowing neural foramens due facet joint hypertrophy, image “C” with osteoarthritis signs, Schmorl nodules, and disk protrusion, the central canal is narrowed. Image “D and E” show axial projection on L3-L4 and L4-L5 disk spaces.

### Case number 2

This is a 46-year-old male patient with past medical history of diabetes mellites type 2 for 7 years, now with cervical and lumbar pain radiated to both arms and legs, with associated cramps on the legs and arms, refers also difficult to pass urine, BMI 28 kg/m<sup>2</sup>, straight leg raising test was negative.

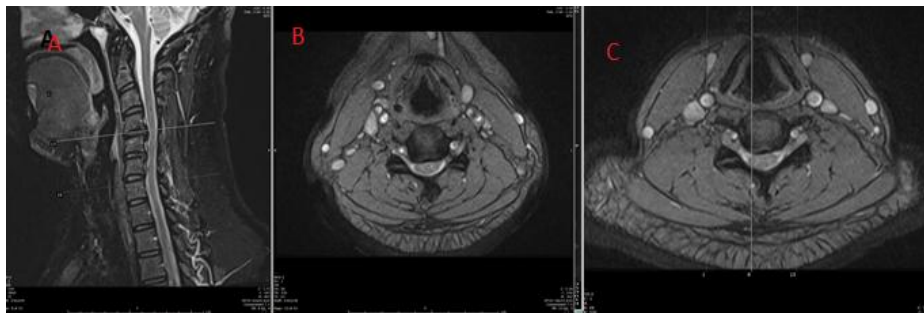
During last three month: glycemia 9.4mmol/L and Hba1C% 8.1 and glycemia 7.7 mmol/L last month.

MRI of the lumbar spine was indicated and showing facet joint hypertrophy from L2-L3 to L5-S1 contacting the dural pouch, mainly on L5-S1 right side with compression of L5 right nerve root; mild narrowing of the central canal from L2-L3 to L5-S1; and narrowing of the neural foramen from L2-L3 to L5-S1. (Fig 2)



**Fig. 2.** MRI Lumbar spine showing narrowing of central canal and bulging disk from L1-L2 to L5-S1, no significant compression of cauda equina nerve root or isolated nerve root (Images A and B) trapped right L5 nerve root at L5-S1 foramen due facet joint hypertrophy (Red arrow images C and D).

Cervical MRI noted focal protrusion in C4-C5 and C5-C6 on the right side, mainly in C5-C6 contacting the spinal cord, inverted cervical lordosis, anterior and posterior cervical osteophytes, and severe narrowing of the central canal from C5 through C6 level. (Fig 3)



**Fig 3.** MRI cervical spine with severe narrowing of central canal (Image A) and cervical focal protrusion of disk C4-C5 (Image B) and C5-C6 (Image C) contacting the medullary cord mainly C4-C5.

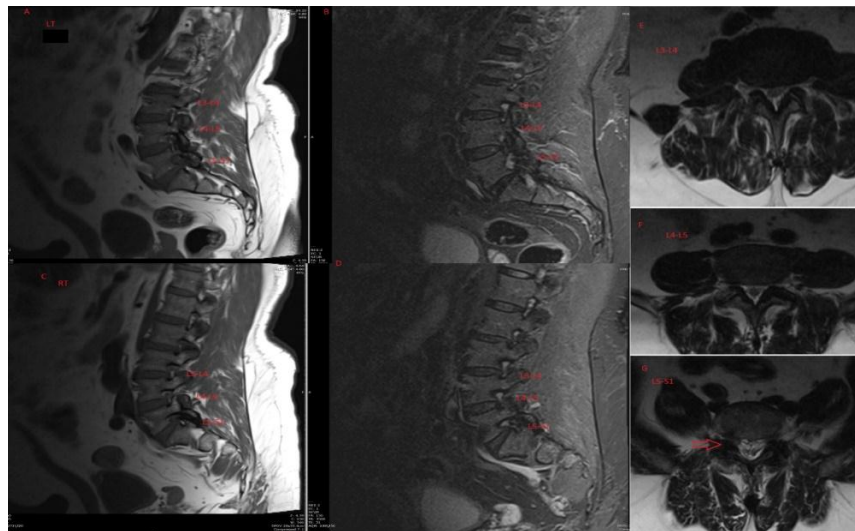
The nerve conduction shows focal motor neuronal neuropathy on the left side and peroneal and sensory ulnar neuropathy on the right side, corresponding with the MRI findings.

Patient is now under physiotherapy treatment and following up with endocrinologist to achieve the properly glycemic control. After some physiotherapy sessions, he felt better.



**Case number 3**

This is a 69-year-old male patient with history of diabetes type 2 for 14 years, with BMI of 33.69kg/m<sup>2</sup>, last glycemia control 6mmol/L, Hb A1% 6.2%, referring lumbar pain, cramps, numbness with weakness that increases after walking at least 200 meters, Lasegue maneuver positive on right side under 35 degrees. MRI was performed showing osteoarthritis of the lumbar spine, narrowing of the central canal, annular protrusion of disk from L1-L2 to L5-S1 contacting the dural pouch, facet joint hypertrophy from L1-L2 to L5-S1 contacting the dural pouch, and narrowing of the neural foramen from L1-L2 to L5-S1, mainly on the right side, L5-S1 with compressed neural ganglia. The nerve conduction had no significant findings; nevertheless, as per images, it is according to the clinical findings. The patient was referred to specialize hospital for surgery treatment. (Fig 4)



**Fig 4.** MRI lumbar spine showing narrowing central foramen on both sides (Images A, B, C, D) mainly right L5-S1 with trapped the nerve ganglia (Images D and G red arrow). Narrowing central canal (Images E, F, G)

**Discussion**

The lumbar pain in diabetes mellitus as per bibliography revised is commonly associated to degenerative changes of the spine. <sup>(2, 9,10,14,15)</sup> The use of imaging, clinical information, clinical examination, lab test and nerve conduction are very useful in the approach, differential diagnosis, prognostic and definition of treatment for patient with history of type 2 diabetes suffering from lumbar pain.

The symptoms and signs in our patients studied are led by lumbar pain, cramps, and numbness. All of three patients had history of diabetes mellitus type 2, and obese or overweight. Individually, the oldest patient had good glycemic control based in the European Diabetes Guideline, the youngest patient had poor glycemic control, and one of them had associated chronic renal disease. None of them was noted to have muscle atrophy of the limbs, altered reflexes or suddenly developed lower extremity weakness. The MRI combined with the clinical information and nerve conduction led the differential diagnostics between degenerative lumbar osteoarthritis in diabetes and amyotrophy diabetes that is clinically associated also with loss of weight and altered reflexes, lower limb muscle atrophy; <sup>(10-13)</sup> only one patient had sensimotor alteration in nerve conduction, although clinical information does not correspond with this disease.

A case report by Goksu Hamit et al in 2018 had suddenly developed lower extremity weakness, admitted in the emergency and transferred to ICU with diabetes ketoacidosis, that means previous poor glycemic control, different to the patient study for us. In this case, the lab tests and images show no significant finding for radicular or medullary compression, electromyographic (EMG) investigation of the left vastus lateralis, adductor magnus, right rectus femoris and adductor longus muscle show spontaneous denervation potentials and neurogenic motor unit potentials. <sup>(10)</sup>

Other patient was presented by McCormack et al in 2018 with lower abdominal pain, with L5-S1 radiculopathy, no medical treatment improvement, associated to numbness, tingling sensation, without bladder or bower loss of control, limited range of motion, no muscle atrophy; all of these symptoms at the moment are similar to the patient brought by us; this patient avoids deep reflex; MRI of the pelvis without contrast was performed with findings suggestive of diabetes amyotrophy, confirmed with nerve conduction showing sensimotor neuropathy. Only one of our

patients had findings in nerve conduction suggestive of sensimotor neuropathy which is one of the symptoms of diabetic amyotrophy; but based in the image findings, as well as the patient not having weight loss and improvement of pain after physiotherapy sessions prescribed, this patient does not have diabetic amyotrophy. These shows the importance of imaging test to rule out the amyotrophy diabetes. <sup>(12)</sup>

Based in the clinical, lab test and imaging findings, we did not have the suspicion of diabetes amyotrophy, and for this reason, simple MRI of the lumbar spine was enough to do the diagnosis. In a case report published by Min Cheol Chang 2017, he used gadolinium-enhanced MRI to identify the exact location of the lesion causing the neuralgic amyotrophy. Gadolinium-enhanced MRI can show inflammation in the neural structures. Nerve enhancement using gadolinium-enhanced MRI is related to the accumulation of gadolinium in the granulation tissue, inflammatory cytokines, and disruption of endoneurial capillaries. In the future, we will take in account the use of MRI with contrast to increase the sensibility of the study in lumbar pain. <sup>(12)</sup>

In our patient, different degrees of osteoarthritis signs are seen using imaging, having relevance the facet joint hypertrophy, several studies concluded that diabetes mellitus increase the presence of osteoarthritis signs in lumbar spine, leading the presence of lumbar pain, disk degeneration and central canal stenosis; some of them suggest this knowledge to prevent it. <sup>(2, 9, 10, 14, 15)</sup>

In study done by Fabiane S M et al 2016, it concluded that it does not have independent relation between obesity and lumbar disk degeneration. <sup>(9)</sup> In our three patients, the most obese patient was the most affected of osteoarthritis signs, as well as oldest. In the future, we can start study using this knowledge to compare it with the international reference.

Study done by Lee CK et al 2019 finalized that diabetes mellitus increases the risk of lumbar degeneration and stenosis, also poor response to treatment, and increasing the cost, the surgical treatment improves the response when compared with conservative treatment. <sup>(1)</sup> Only one of our patients was suggested surgical treatment, the rest have good response with conservative treatment in short time, should be assessed over time and using largest population to assess it.

In a research done by Liu et al 2018, it showed that there was a positive relationship between type 2 diabetes and lumbar disc degeneration. Furthermore, a longer type 2 diabetes duration

and a bad control of type 2 diabetes could aggravate disc degeneration. However, the exact mechanism by which type 2 diabetes causes lumbar disc degeneration remains to be elucidated,<sup>(15)</sup> as well as mentioned above, facet joint hypertrophy had relevance in our study.

## Conclusions

After reviewing these three patients, we conclude that lumbar osteoarthritis with canal stenosis is common cause of lumbar pain in our patients due facet joint hypertrophy; so, we recommend imaging, nerve conduction and physical examination as useful tools in the differential diagnosis between lumbar osteoarthritis and neuropathies due diabetes mellitus type 2.

We suggest doing a widely research regarding with early osteoarthritis sign in diabetes mellitus patient in our facility to increase the knowledge of this entity.

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#### **Conflicts of interest**

The authors declare no conflict of interest.

#### **Authorship Contribution**

Alexander Sosa Frías, as the main author, originated the idea of the topic on: Osteoarthritis in diabetes mellitus type II, imaging approach. Number of cases. He designed the research and contributed to the discussion of the case.

Alina Jaqueline Vallejo Ramírez, contributed to the design of the research, participated in the search for updated information and in the processing of the information.

Ana Elvis Figueredo Molina, contributed to the research design, participated in the writing and correction of the article.

I, Alexander Sosa Frías, on behalf of the co-authors, declare the truth of the content of the article: Osteoarthritis in type II diabetes mellitus, imaging approach. Number of cases.