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CONSERVATIVE MANAGEMENT OF LATERAL COLLATERAL LIGAMENT INJURY DUE TO CHIROPRACTIC INTERVENTION IN A POLICE OFFICER WITH MULTIPLE COMORBIDITIES: A CASE REPORT

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Abstract

A 56-year-old man, an active police officer, complained of acute pain and instability of the right knee. Medical history included an unoperated total rupture of the right anterior cruciate ligament (ACL) at the age of 23 years and grade 3 right genu osteoarthritis. Comorbidities included obesity (BMI 31.2 kg/m²), hypertension, dyslipidemia, hyperuricemia, and herniated nucleus pulposus (HNP). Physical examination revealed grade 1 right lateral collateral ligament (LCL) laxity, tenderness at the lateral joint line, limited range of motion, and crepitation. MRI confirmed right ACL rupture, right LCL sprain, medial meniscus tear, and grade 3 osteoarthritis. Conservative management included etoricoxib for pain, febuxostat for hyperuricemia, amlodipine for hypertension, rosuvastatin for dyslipidemia, anti-inflammatory herbal supplements, and omeprazole for gastrointestinal protection. Joint aspiration was performed to reduce effusion, and intra-articular Platelet-Rich Plasma (PRP) therapy was applied. The patient underwent a three-month physical rehabilitation program in three phases: initial, intermediate, and advanced. Therapeutic modalities included TENS, therapeutic ultrasound, gentle massage, muscle strengthening, proprioceptive, and aerobic exercises. The use of crutches and knee braces was reduced as joint stability and strength improved. During rehabilitation, patients showed significant progress: decreased pain, improved range of motion, muscle strength, and joint stability, and the ability to return to professional activities. The comprehensive approach and interdisciplinary collaboration enabled optimal functional recovery despite the presence of comorbidities and complex medical history.

Keywords: LCL injury, knee instability, conservative management

Introduction

The anterior cruciate ligament (ACL) plays a crucial role in the anteroposterior and rotational stability of the knee joint, especially in physically active individuals (Filbay & Grindem, 2019). ACL ruptures often result from sports trauma or activities involving pivoting movements and sudden changes in direction. If not adequately treated, ACL ruptures can lead to chronic knee instability, increase the risk of secondary injury to other intra-articular structures, such as the meniscus and cartilage, and accelerate the progression of knee osteoarthritis (OA) (Whittaker et al., 2022).

Knee OA is one of the leading causes of disability in the adult and elderly population, characterized by progressive degeneration of articular cartilage, remodeling of subchondral bone, osteophyte formation, and mild to moderate synovitis (Hunter & Bierma-Zeinstra, 2019). Risk factors for knee OA include advanced age, obesity, history of joint injury, and excessive physical activity (Kloppenburg & Berenbaum, 2020). Obesity not only increases the mechanical load on the knee joint but also induces a systemic inflammatory response through the production of proinflammatory adipokines from adipose tissue, which contributes to the pathogenesis of OA (Thijssen et al., 2015).

Comorbidities such as hypertension, dyslipidemia, and hyperuricemia also play a role in exacerbating the joint degenerative process through inflammatory and vascular mechanisms (Courties et al., 2017). Management of patients with chronic ACL rupture and advanced knee OA with complex comorbidities requires a multidisciplinary approach combining pharmacological interventions, physical rehabilitation, and lifestyle modifications (Guillemin et al., 2021). Conservative therapy is an important option, especially in patients with high perioperative risk or preference to avoid surgical intervention (Ardern et al., 2018).

Structured and intensive physical rehabilitation is effective in improving knee function, joint stability, and quality of life in patients with chronic ACL rupture and knee OA (van Melick et al., 2016). Therapeutic modalities such as muscle strengthening exercises, proprioceptive, and the use of physical modalities such as TENS and therapeutic ultrasound can reduce pain and improve functional capacity (X.-Q. Wang et al., 2012). This case report presents a comprehensive approach to managing a patient with chronic ACL total rupture and grade 3 knee OA with complex comorbidities, highlighting the role of structured rehabilitation and interdisciplinary collaboration in achieving optimal functional recovery.

This case report highlights the rare occurrence of LCL injury induced by chiropractic intervention in a patient with significant comorbidities. Although chiropractic manipulation is generally considered safe, there is a potential risk of unforeseen complications, especially in individuals with complex underlying health conditions. By discussing this unique case, we hope to raise awareness of potential risks and emphasize the importance of comprehensive patient evaluation before undertaking alternative therapies.

In addition, we will discuss conservative management strategies and evaluate their effectiveness in dealing with complex cases such as this. By emphasizing noninvasive

approaches, we aim to demonstrate how individualized treatment plans can yield positive outcomes despite complicating factors. This discussion provides valuable insights into the potential of conservative therapy in the management of complicated clinical scenarios and offers guidance for practitioners facing similar cases.

Case Report

A 56-year-old man, an active police officer by profession, presented with complaints of acute pain and instability in the right knee. The patient was 168 cm tall and weighed 88 kg, resulting in a Body Mass Index (BMI) of 31.2 kg/m², indicating obesity.

The patient's medical history was complex, especially in orthopedics, including a complete rupture of the anterior cruciate ligament (ACL) at the age of 23 that was never treated surgically, as well as grade 3 osteoarthritis (OA) of the right knee. The patient was also diagnosed with herniated nucleus pulposus (HNP). Concomitant systemic conditions included hyperuricemia (last uric acid 8.8 mg/dL), hypertension, and dyslipidemia (last total cholesterol 230 mg/dL). There was no family history of similar complaints. The current complaint arose after the patient underwent chiropractic massage therapy focusing on the hip area in an attempt to reduce low back pain due to HNP. Soon after the session, she experienced an acute onset of severe pain on the lateral side of the right knee, which was aggravated by walking. The complaint was accompanied by minimal swelling and a sensation of instability, as if the knee would "give way". The patient's excess weight was thought to have contributed to the increased mechanical load on the knee joint, exacerbating his symptoms.

On physical examination, vital signs were within normal limits. Inspection of the right knee revealed minimal swelling without redness or increased local temperature. Palpation revealed tenderness at the lateral joint line. The varus stress test was positive Grade 1, indicating laxity of the lateral collateral ligament (LCL). Lachman's test and anterior drawer test were negative, indicating no current ACL instability. McMurray test was negative. There was pain at the LCL insertion posterior to the fibula head. Knee range of motion (ROM) was limited; maximal flexion was 90 degrees due to pain, with crepitus indicating changes due to OA. Gait analysis revealed an antalgic walking pattern with reduced weight bearing on the right side. The patient used crutches to reduce the load on the right knee during ambulation.

Imaging studies were performed to confirm the clinical findings. Magnetic resonance imaging (MRI) of the right knee revealed some important findings. The MRI showed complete rupture of the right anterior cruciate ligament (ACL) and sprain of the right lateral collateral ligament (LCL). There was focal epiphyseal bone marrow edema at the mid-epiphysis of the right proximal tibia. In addition, there was a complex tear of the posterior horn of the medial meniscus in the peripheral-central zone, right patellofemoral medial plica syndrome, and joint effusion in the right peri and suprapatellar region. The findings also showed grade 3 right genu osteoarthritis with cartilage defects in the right trochlea and tibia, and calcifications in the right popliteal region.

Radiographs of the right knee on the same date revealed bilateral grade 3 genu osteoarthritis with subchondral defects on the os aspect of the right femur. There was subluxation of the right os patella laterally and enthesopathy of the left os patella. Calcification was also detected in the popliteal region bilaterally. In addition, metallic

density prostheses were identified on the medial aspect of the medial condyle of the left distal femur and left proximal tibia.

Knee ultrasonography confirmed a partial tear of the LCL with hypoechoic areas indicating ligament fibers disruption. Significant joint effusion was also detected through this examination.

Based on clinical and imaging findings, the working diagnosis included total rupture of the right ACL (chronic), grade 3 right genu osteoarthritis of the medial compartment, grade 1 right LCL sprain, medial meniscus tear, synovitis, and suspected gouty arthritis of the right knee.

The treatment approach chosen was conservative management with the aim of restoring knee function, improving joint stability and enabling the patient to return to professional activities that demand high physical readiness.

Medicamentous therapy included the administration of etoricoxib 120 mg once daily for pain management, febuxostat 80 mg once daily for hyperuricemia, amlodipine 5 mg once daily for hypertension, and rosuvastatin 20 mg once daily for dyslipidemia. Patients also received twice-daily anti-inflammatory herbal supplements containing *Boswellia serrata* extract 100 mg, *Curcuma longa* extract 250 mg, Bioperine 2.5 mg, and vitamin K2 22.5 mcg. For gastrointestinal protection, omeprazole 40 mg was given twice daily.

Due to significant joint effusion, a joint aspiration (arthrocentesis) was performed which yielded 12 cc of clear synovial fluid. This procedure helped to reduce the intra-articular pressure and pain experienced by the patient.

Patients underwent Platelet-Rich Plasma (PRP) therapy by intra-articular injection into the lateral compartment of the knee. The number of sessions is customized based on the patient's clinical response, generally three sessions at two-week intervals. PRP therapy aims to promote tissue healing and reduce inflammation.

An intensive physiotherapy program was initiated early on and tailored to the patient's needs. Therapeutic modalities include Transcutaneous Electrical Nerve Stimulation (TENS) to reduce pain through sensory nerve stimulation, as well as therapeutic ultrasound (US) to improve circulation and accelerate tissue healing. Light massage was performed on the area around the knee and thigh to reduce muscle tension and improve blood flow.

Quadriceps and hamstring muscle strengthening exercises start with isometric exercises and progress to light resistance exercises, aiming to improve joint stability and biomechanical function of the knee. Range of motion (ROM) exercises are performed gradually, starting from passive, active-assistive, to fully active movements, with the aim of achieving optimal flexion and extension. In addition, proprioceptive exercises and gait training were applied to improve balance, coordination, and normal walking patterns. The physiotherapy program was carried out with a frequency of three times a week for three months.

The use of assistive devices such as crutches and knee braces was continuous for three months to reduce the load on the knee and provide additional stabilization. The use of these aids was then gradually reduced as the patient's condition improved.

This comprehensive approach aims to optimally restore knee function, allowing patients to return to daily activities and professional duties with maximum performance and minimal risk of re-injury. Therapy adjustments take into account the patient's comorbidities and physical condition, ensuring that rehabilitation is safe and effective. By integrating modalities such as PRP, TENS, US, and a structured exercise program, it

is hoped that patients can achieve maximum functional recovery despite having a complex medical history.

The physical rehabilitation program is designed in three phases-early, intermediate and advanced-with the aim of restoring optimal knee function, improving joint stability and enabling patients to return to their professional activities that demand high physical readiness. Each phase is structured according to the principles of sports medicine and tailored to the patient's comorbid conditions, including obesity, hypertension, and HNP. Close monitoring of the improvement is done to ensure the effectiveness of the intervention and allow for adjustment of the therapy as needed.

In the early phase (weeks 1-4), the main focus is on reducing pain, swelling and inflammation, and restoring the initial range of motion (ROM) in the knee joint. Physical therapy modalities used include Transcutaneous Electrical Nerve Stimulation (TENS) to reduce pain through sensory nerve stimulation and pain impulse modulation, and therapeutic ultrasound (US) which utilizes high-frequency sound waves to improve local blood circulation, reduce edema, and accelerate tissue healing. Gentle massage to the area around the knee and thigh was performed to reduce muscle tension, promote tissue relaxation, and prepare the muscles for further exercise.

Range of motion (ROM) exercises begin with passive and active-assistive movements within the limits of pain tolerance, aiming to increase flexibility and prevent joint stiffness. Patellar mobilization is performed to prevent tissue adhesion and improve joint mobility. Isometric muscle strengthening exercises on the quadriceps and hamstrings are applied to maintain muscle mass and strength without putting excessive stress on the knee joint. Core stability exercises help improve pelvic and spinal stability, reducing the load on the knee.

Monitoring improvement in this phase involves daily pain evaluation using the Visual Analog Scale (VAS) or Numeric Scale (NRS), weekly measurement of knee ROM, observation of swelling, and assessment of patient tolerance to exercise. The patient's engagement in completing exercise sessions without an increase in pain is an indicator of therapeutic progress.

In the intermediate phase (weeks 5-8), therapy focuses on improving muscle strength, joint stability, and functional capacity. Dynamic muscle strengthening exercises are performed with light resistance using therabands or light weights for the quadriceps, hamstring and calf muscles, with the intensity gradually increased according to patient tolerance. Proprioceptive and balance exercises, such as single-leg standing and balance board use, were applied to improve joint stability and neuromuscular control.

Low-impact aerobic exercises, such as walking on a treadmill with gradually increased speed and duration, as well as aquatic therapy to reduce the gravitational load on the joint, were included in the rehabilitation program. ROM improvement continued with the target of gradually achieving full flexion, including stretching of the knee flexor and extensor muscles to increase flexibility.

In the advanced phase (weeks 9-12), the goal of rehabilitation is to return the patient to the full functional activity level that their profession demands. Intensive muscle strengthening exercises are performed with moderate to heavy resistance using exercise machines or free weights, with close supervision to prevent injury. Multi-joint exercises such as leg presses, squats and lunges are applied to improve strength and stability. Job-specific functional exercises, including light plyometric exercises such as side steps and mini squats, as well as agility exercises with lateral movement patterns and direction changes, are designed to simulate the activities required in policing duties.

Gait training is introduced gradually, starting with light jogging if patient tolerance allows, focusing on correct technique to optimize biomechanics and reduce stress on the knee. Cardiovascular exercises such as stationary cycling or swimming are added to improve cardiovascular fitness without overloading the knee joint.

During the entire rehabilitation program, patients are monitored regularly to assess progress and make therapy adjustments as needed. Interdisciplinary collaboration between orthopedic doctors and physiotherapists ensures periodic evaluation and ongoing management of comorbidities such as hypertension, dyslipidemia and hyperuricemia. Modifications to exercise intensity and type are made based on patient response and monitoring results, with attention to side effects or exacerbation of comorbid conditions.

A psychological evaluation is also considered to ensure patient motivation and compliance in the rehabilitation program, as well as address any mental or emotional barriers that may affect recovery. Active patient involvement and psychosocial support are important aspects in achieving optimal outcomes.

Month One, the patient had a significant decrease in pain and swelling, allowing for increased activity. ROM increased past 90 degrees, although it had not yet reached the full range. Improvements in flexibility and movement control began to be seen. Month Two, there was an increase in muscle strength around the knee, with better joint stability and confidence in activities. Reliance on an assistive cane was reduced, and the patient was able to walk for longer periods of time with minimal support. Daily activities are performed more efficiently and without excess discomfort. Third Month, ROM is close to normal, allowing almost full flexion and extension. The patient is able to perform more demanding physical activities, including work tasks. Physical fitness improves, meeting the requirements for return to police duties. Cardiovascular fitness and endurance improved through regular aerobic exercise.

A gradual and structured rehabilitation approach, with close monitoring of improvement, enables patients to achieve maximum functional recovery. Therapy adjustments based on measured progress ensure that interventions remain relevant and effective throughout the rehabilitation process. Interdisciplinary collaboration and active patient involvement are key to success in managing complex cases with comorbidities and specialized functional needs.

Results and Discussion

This case highlights the rare occurrence of a lateral collateral ligament (LCL) injury sustained by a 56-year-old male patient, an active police officer. Anamnesis revealed a history of total rupture of the anterior cruciate ligament (ACL) at the age of 23 years which was never treated surgically. Chronic knee instability due to ACL deficiency can increase the risk of meniscus damage and accelerate the development of knee osteoarthritis (OA) later in life (V. L. Johnson & Hunter, 2014). Clinical studies have shown that biomechanical imbalances due to unrepaired ACL injuries can cause excessive stress on other intra-articular structures, including the meniscus and articular cartilage (Filbay & Grindem, 2019).

The patient was also previously diagnosed with grade 3 OA of the right knee. OA is a degenerative joint disease characterized by progressive destruction of the articular cartilage, changes in the subchondral bone, and mild synovial inflammation (Hunter & Bierma-Zeinstra, 2019). Major risk factors for knee OA include advanced age, obesity,

history of joint injury, and strenuous physical activity (Kloppenburg & Berenbaum, 2020). The patient's obesity, with a Body Mass Index (BMI) of 31.2 kg/m², was a significant risk factor that increased the mechanical load on the knee joint and contributed to the systemic inflammatory process through adipokines produced by fat tissue (Thijssen et al., 2015).

In addition, the patient had a history of herniated nucleus pulposus (HNP) causing low back pain. The patient's efforts to reduce pain through chiropractic massage therapy focusing on the hip area may have affected her knee biomechanics and stability. Manipulations to the spine and pelvis can alter gait patterns and weight distribution on the lower extremities, potentially triggering an exacerbation of symptoms in an already degenerated knee (Balthazard et al., 2014).

The patient's complaint of severe pain on the lateral side of the right knee aggravated by walking, accompanied by a sensation of the knee "giving way", suggests the possibility of additional injury to the lateral stabilizing structures of the knee, such as the lateral meniscus or lateral collateral ligament (M. D. LaPrade et al., 2015). This sensation of instability may be exacerbated by pre-existing ACL deficiency, which interferes with the anterolateral stability mechanism of the knee (Brockmeyer et al., 2019).

The patient's comorbid conditions included hyperuricemia with a uric acid level of 8.8 mg/dL, hypertension, and dyslipidemia with a total cholesterol level of 230 mg/dL. Although there were no signs of acute gouty arthritis, hyperuricemia can contribute to the inflammatory process and cartilage degradation through the formation of microscopic uric acid crystals (Ritchie & Rothberg, 2014). Hypertension and dyslipidemia can affect the microcirculation and nutrition of joint tissues, and are associated with increased systemic inflammation that can accelerate the progression of OA (Yan, 2018).

The absence of a family history of similar complaints suggests that genetic factors may play less of a role, while mechanical and metabolic factors have a more dominant contribution in this case. Overall, the patient's history indicates that the acute pain and instability of the right knee is the result of a complex interaction between a history of structural injury, joint degeneration, obesity, biomechanical adjustments due to HNP, and comorbid conditions that exacerbate inflammation and tissue damage.

On physical examination, the patient's vital signs were within normal limits, indicating hemodynamic stability and absence of signs of systemic infection or severe inflammation. Inspection of the right knee revealed minimal swelling with no localized redness or elevated temperature. This indicated that although there was an inflammatory process, its severity was low and most likely related to the patient's grade 3 osteoarthritis (OA). Mild joint effusion in OA often results from low-grade synovitis accompanying cartilage degeneration (Robinson et al., 2016).

Palpation reveals tenderness over the lateral joint line of the right knee. Pain in this area indicates possible involvement of anatomical structures such as the lateral meniscus, lateral collateral ligament (LCL), or lateral articular cartilage. LCL involvement is supported by the finding of pain at the LCL insertion posterior to the fibula head. Injury

or tendinopathy to the LCL may cause localized pain and increase knee instability (Song et al., 2014).

The varus stress test showed a Grade 1 positive result, indicating laxity or weakness in the LCL without complete rupture. This laxity may cause lateral instability of the knee and contribute to the patient's reported "detached" knee sensation. Although the patient had a history of non-surgically treated anterior cruciate ligament (ACL) total rupture, the Lachman test and anterior drawer test were negative. This indicated that there was currently no significant instability of the ACL, possibly due to neuromuscular adaptation or compensation from the surrounding muscles that improved joint stability (Ardern et al., 2018).

A negative McMurray test indicates the absence of clinically significant meniscus tears. However, it should be noted that the sensitivity of this test is not always high, so meniscus injury is still possible despite a negative test result (Smith et al., 2015). The range of motion (ROM) of the right knee was limited with maximal flexion of 90 degrees due to pain, accompanied by crepitation. Crepitation is a typical sign of OA, indicating uneven articular surfaces due to cartilage degradation and osteophytes (Kloppenburg & Berenbaum, 2020). This ROM limitation impacted the patient's functional ability, especially in performing his duties as an active police officer.

Analysis of the patient's gait revealed an antalgic walking pattern, where the patient puts less weight on the right side to avoid pain. This leads to unbalanced weight distribution and can affect the contralateral limb as well as the spine. The use of crutches during ambulation helps to reduce pressure on the right knee, but also demonstrates the level of dependency and disability the patient experiences (van der Marck et al., 2014). The antalgic walking pattern and the use of a walker may contribute to muscle weakness and postural problems if it persists in the long term.

Overall, these physical examination findings suggested that the patient was experiencing the consequences of a combination of grade 3 OA and LCL laxity of the right knee. LCL involvement explained the lateral pain and sensation of instability, while ROM limitation and crepitation were associated with advanced OA. Weakness in the stabilizing structures of the knee, coupled with risk factors such as obesity and history of previous injury, worsened the patient's condition. These findings emphasize the importance of comprehensive treatment that includes orthopedic intervention, physical rehabilitation and lifestyle modification to improve knee function and quality of life.

Imaging studies performed on the patient provided a comprehensive picture of his right knee condition. Magnetic resonance imaging (MRI) results showed a total rupture of the right anterior cruciate ligament (ACL) and a sprain of the right lateral collateral ligament (LCL). The chronic ACL rupture was consistent with the patient's history of injury at the age of 23 without surgical intervention. Chronic ACL rupture can lead to anteroposterior and rotational instability of the knee, increasing the risk of damage to other structures such as the meniscus and articular cartilage due to abnormal loading on the joint (Mu, 2018).

A right LCL sprain indicates an acute injury to this ligament, causing laxity and pain on the lateral side of the knee. LCL injuries can result from varus stress or rotational trauma and contribute to lateral instability of the knee (R. F. LaPrade et al., 2014) . The finding of focal epiphyseal bone marrow edema in the right proximal tibia indicates bone marrow edema (BME), which is often associated with excess mechanical stress or microfractures in the subchondral bone. BME can be a source of pain and is associated with the progression of osteoarthritis (OA) (Kornaat et al., 2006).

Complex tears of the posterior horn of the medial meniscus in the peripheral-central zone show significant damage to the medial meniscus. Meniscus tears are common in patients with knee OA and can aggravate pain and joint function limitations (Englund et al., 2008). The meniscus plays an important role in load distribution and joint stability; its damage can accelerate articular cartilage degeneration.

MRI-detected right medial patellofemoral plica syndrome can cause anterior knee pain and limitation of motion. Inflamed or thickened plica may rub against the femoral condyle during movement, causing clinical symptoms (Dincyurek et al., 2015).

Joint effusion in the right peri and suprapatellar region indicates synovitis, which is often found in OA and other intra-articular injuries. Synovitis may contribute to knee pain and swelling (Robinson et al., 2016).

The findings of grade 3 right genu osteoarthritis with cartilage defects in the right trochlea and tibia showed significant cartilage destruction and narrowing of the joint gap. Grade 3 OA is categorized as moderate to severe OA with obvious structural damage on imaging (Kloppenburg & Berenbaum, 2020). Calcification in the right popliteal region may indicate calcium crystal deposition in the soft tissue, as in chondrocalcinosis, which can occur along with OA (W. Zhang et al., 2011).

Right knee radiographs showed grade 3 bilateral genu osteoarthritis with subchondral defects of the right femoral os, confirming the MRI findings. Subluxation of the right patellar os laterally suggests maltracking of the patella, which may cause patellofemoral pain syndrome and increase stress in the lateral compartment (Post et al., 2017). Enthesopathy of the left patellar os suggests degenerative changes at the tendon or ligament attachment sites due to repetitive mechanical loading (McGonagle et al., 2017). Calcification in the bilateral popliteal region is also consistent with calcium deposition in the soft tissues.

The presence of metal density prostheses on the medial condyles of the left distal femur and left proximal tibia indicated that the patient had undergone a previous surgical procedure on the left knee, possibly a partial or total arthroplasty. This adds complexity to the patient's biomechanics and may affect the load distribution during walking.

Knee ultrasonography confirmed a partial tear of the LCL with hypoechoic areas indicating ligament fibers disruption. Significant joint effusion was also detected, supporting the synovitis findings from MRI and radiographs.

A patient with complaints of right knee pain and instability underwent a comprehensive clinical and imaging evaluation. The examination results led to the diagnosis of chronic right anterior cruciate ligament (ACL) total rupture, grade 3 right

genu osteoarthritis of the medial compartment, grade 1 right lateral collateral ligament (LCL) sprain, medial meniscus tear, synovitis and suspected gouty arthritis of the right knee.

Chronic total ACL ruptures that are not treated surgically can lead to anteroposterior and rotational instability of the knee. This condition increases the risk of re-injury and damage to other intra-articular structures such as the meniscus and articular cartilage (Ardern et al., 2018). For physically active and professional patients, knee instability can interfere with daily activities and work.

Grade 3 right genu osteoarthritis (OA) shows significant cartilage destruction, narrowing of the joint gap, subchondral sclerosis, and formation of large osteophytes (Kloppenburg & Berenbaum, 2020). OA of the medial compartment causes pain, crepitus, and limitation of motion which negatively affects the patient's quality of life and function.

Grade 1 right LCL sprain is a minor injury that causes minimal laxity and pain on the lateral side of the knee. The LCL plays an important role in knee stability against varus stress, and this injury can exacerbate existing instability due to ACL rupture (R. F. LaPrade et al., 2018). Medial meniscus tears are common with OA and ligament injuries. The meniscus functions in load distribution and joint stability; its damage can increase pain and accelerate cartilage degeneration (Englund et al., 2012).

Synovitis is characterized by inflammation of the synovial membrane leading to joint effusion and pain. In patients with hyperuricemia, suspicion of gouty arthritis should be considered even if the synovial fluid appears clear, as monosodium urate crystals can trigger a significant inflammatory response (Dalbeth et al., 2016).

The treatment approach chosen was conservative management with the aim of restoring knee function, improving joint stability and enabling the patient to return to her professional activities. Medicamentous therapy included the administration of etoricoxib 120 mg once daily to reduce pain and inflammation. Etoricoxib is a selective COX-2 inhibitor that is effective in managing pain in OA and other musculoskeletal conditions (Bingham et al., 2007). Febuxostat 80 mg once daily was given to manage hyperuricemia; as a xanthine oxidase inhibitor, febuxostat effectively reduces serum uric acid levels and prevents gouty arthritis attacks (Khanna et al., 2012).

To control hypertension, amlodipine 5 mg once daily is given. Blood pressure control reduces cardiovascular risks that may affect OA conditions (Williams et al., 2018). Rosuvastatin 20 mg once daily is used for dyslipidemia; in addition to lowering LDL cholesterol, statins also have anti-inflammatory effects that may be beneficial in reducing OA progression (Jahangiri et al., 2019).

Patients also received a twice-daily anti-inflammatory herbal supplement containing 100 mg Boswellia serrata extract, 250 mg Curcuma longa extract, 2.5 mg Bioperine, and 22.5 mcg vitamin K2. Boswellia serrata and Curcuma longa have anti-inflammatory and analgesic properties, which may help reduce pain and improve joint function (Daily et al., 2016). Bioperine is used to increase the bioavailability of curcumin from Curcuma longa, while vitamin K2 plays a role in bone metabolism and cartilage health (O'Connor et al., 2017). Omeprazole 40 mg twice daily was given as

gastrointestinal protection to prevent ulceration due to long-term use of NSAIDs such as etoricoxib (Rustemovic et al., 2011).

Due to significant joint effusion, a joint aspiration (arthrocentesis) was performed, which yielded 12 cc of clear synovial fluid. This procedure aims to reduce intra-articular pressure and pain and improve joint range of motion. Arthrocentesis also allows synovial fluid analysis to evaluate for infection or uric acid crystals (Roddy et al., 2020).

The patient underwent Platelet-Rich Plasma (PRP) therapy by intra-articular injection into the lateral compartment of the knee. PRP contains a high concentration of growth factors that can stimulate the tissue repair process, reduce inflammation, and slow the progression of OA (Dai et al., 2017). This therapy is expected to reduce pain and improve knee function. The number of PRP sessions is customized based on the patient's clinical response, generally three sessions at two-week intervals (Campbell et al., 2015).

This conservative approach was chosen considering the age and preference of the patient, who wanted a non-surgical solution to be able to return to her professional activities. In addition, medical comorbidities such as hypertension and dyslipidemia increase the risk of perioperative complications, so conservative management was considered safer. Clinical evidence supports the effectiveness of PRP therapy and intensive rehabilitation in improving knee function and reducing pain in OA and ligament injuries (Filardo et al., 2015).

In addition to medical intervention, patients are directed to undergo a structured physiotherapy program to strengthen the muscles around the knee, improve proprioception, and improve walking patterns (van Melick et al., 2016). Education on weight loss through appropriate diet and physical activity is essential, as patient obesity contributes significantly to increased mechanical load on the knee and progression of OA (Dias et al., 2015).

The physical rehabilitation program designed for this patient aims to restore optimal knee function, improve joint stability, and enable the patient to return to his professional activities as a police officer, which requires high physical readiness. This comprehensive approach considers the patient's comorbidities, including obesity, hypertension, and herniated nucleus pulposus (HNP), and focuses on sports medicine principles organized in three phases: initial, intermediate, and advanced.

In the early phase (weeks 1-4), the main focus is on reducing pain, swelling, and inflammation and restoring the range of motion (ROM) of the knee joint. The therapeutic modalities used include Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic ultrasound (US), and light massage. TENS is applied to reduce pain through sensory nerve stimulation and modulation of pain impulses at the spinal cord level. TENS is effective in pain management in acute and chronic musculoskeletal conditions (M. I. Johnson & Paley, 2017). Therapeutic ultrasound increases local blood circulation, reduces edema, and accelerates tissue healing through its thermal and mechanical effects; studies have shown that US can help reduce pain and improve function in knee osteoarthritis (Q. Wang et al., 2014). Light massage of the area around the knee and thigh aims to reduce

muscle tension, promote relaxation, and improve blood flow, which can help reduce pain and improve muscle function (Field, 2016).

Range of motion (ROM) exercises start with passive and active-assistive movements within the limits of pain tolerance and aim to increase flexibility and prevent joint stiffness. Patellar mobilization is performed to prevent tissue adhesion and improve joint mobility (Renan-Ordine et al., 2011). Isometric muscle strengthening exercises on the quadriceps and hamstring are applied to maintain muscle mass and strength without putting excessive stress on the knee joint. Isometric strengthening is beneficial in the early rehabilitation phase when pain is still significant (Gieger et al., 2016). Core stability exercises are also performed to improve pelvic and spinal stability, reduce load on the knee, and improve overall posture (Huxel Bliven & Anderson, 2013).

In the intermediate phase (weeks 5-8), therapy improves muscle strength, joint stability, and functional capacity. Dynamic muscle strengthening exercises are performed with light resistance using therabands or light weights for the quadriceps, hamstring, and calf muscles, with the intensity gradually increased according to patient tolerance (Heinrich et al., 2011). Proprioceptive and balance exercises, such as standing on one leg and use of a balance board, are applied to improve neuromuscular control and knee stability (Gokeler et al., 2012). Low-impact aerobic exercises, such as walking on a treadmill with gradually increased speed and duration, as well as aquatic therapy, are included in the rehabilitation program. Aquatic therapy effectively improves functional capacity and reduces pain in patients with knee osteoarthritis, as water helps reduce the gravitational load on the joint (Y. Zhang et al., 2016). ROM improvement is continued with the target of gradually achieving full flexion, including stretching of the knee flexor and extensor muscles to improve flexibility and reduce the risk of injury (Coppieters et al., 2002).

In the advanced phase (weeks 9-12), the goal of rehabilitation is to return the patient to a full functional activity level as per the demands of their profession. Intensive muscle strengthening exercises are performed with moderate to heavy resistance using exercise machines or free weights, with close supervision to prevent injury (Dias et al., 2015).Multi-joint exercises such as leg presses, squats, and lunges are applied to improve strength and stability. Job-specific functional exercises, including light plyometric exercises such as side steps and mini hops and agility exercises with lateral movement patterns and direction changes, were designed to simulate the activities required in police duties (Cowen et al., 2016). Gait and running training were introduced gradually, starting with light jogging if patient tolerance allowed, focusing on the correct technique to optimize biomechanics and reduce stress on the knee (Lenhart et al., 2014). Cardiovascular exercises such as stationary cycling or swimming were added to improve cardiorespiratory fitness without stressing the knee joint (Moon et al., 2015).

The use of assistive devices such as crutches and knee braces was continuous for the first three months to reduce the load on the knee and provide additional stabilization. The use of these aids is then gradually reduced as the patient's condition improves. A knee

brace can assist in joint stabilization during activity and reduce the risk of re-injury, especially in individuals with ligament instability (Thij et al., 2010).

Regular patient monitoring is crucial during the rehabilitation program to assess progress and adjust therapy according to individual needs. Interdisciplinary collaboration between orthopedic doctors and physiotherapists ensures comprehensive periodic evaluations, allowing for ongoing management of comorbidities such as hypertension, dyslipidemia, and hyperuricemia. Adjustments to exercise intensity and type are made based on patient response and monitoring results, with special attention to side effects or exacerbation of comorbid conditions. This approach is in line with current clinical practice that emphasizes the importance of adaptation of rehabilitation interventions in patients with complex comorbidities (Lennon et al., 2018).

Psychological evaluation is also an integral component of rehabilitation programs. Ensuring patient motivation and compliance helps overcome mental or emotional barriers affecting recovery. Studies show that psychological interventions and emotional support can improve adherence to rehabilitation programs and overall clinical outcomes (Hall et al., 2010). Active patient engagement and psychosocial support contribute significantly to achieving optimal outcomes, especially in cases with high complexity and special functional needs (Taylor et al., 2010). A holistic approach that includes both physical and psychological aspects ensures that recovery is focused on physical improvement and mental and emotional well-being, which is essential for the sustainability of rehabilitation outcomes (Holden et al., 2012).

During the first month of rehabilitation, the patient experienced a significant reduction in pain and swelling, allowing for increased daily activity. Knee range of motion (ROM) increased past 90 degrees, although not yet to full range. Flexibility and movement control improvements began to be seen, reflecting a positive response to therapy interventions. Decreased pain and swelling also improved the patient's sleep quality and comfort (Wainwright et al., 2016).

By the second month, muscle strength was improved around the knee, with better joint stability and increased confidence in activities. Reliance on a walking stick was reduced, and the patient could walk longer with minimal support. Daily activities such as climbing stairs and walking medium distances were performed more efficiently and without excess discomfort. This improvement demonstrates the effectiveness of the strengthening and proprioceptive exercises applied (Rodriguez-Merchan, 2016).

By the third month, the range of motion was close to normal, allowing almost full flexion and extension. The patient could perform more demanding physical activities, including professional duties as a police officer, requiring high physical readiness. Physical fitness improved, meeting the requirements for returning to police duty. Regular aerobic exercise improves cardiovascular fitness and endurance, reducing the risk of fatigue on duty (Ellingson et al., 2014).

This gradual and structured approach to rehabilitation, with close monitoring of improvement, enables patients to achieve maximum functional recovery. Therapy adjustments based on measured progress ensure that interventions remain relevant and

effective throughout rehabilitation. Interdisciplinary collaboration between the medical team and active patient involvement are the keys to success in managing complex cases with comorbidities and special functional needs.[59] With this strategy, patients recover physically and regain optimal quality of life, ready to return to their professional roles with maximum ability.

Conclusion

A 56-year-old male patient with a history of non-surgical right anterior cruciate ligament (ACL) total rupture and grade 3 right genu osteoarthritis achieved optimal functional recovery through a comprehensive conservative management approach. This management included medicamentous therapy to control pain, inflammation, and comorbidities such as hypertension, dyslipidemia, and hyperuricemia, as well as minimal interventions such as joint aspiration and Platelet-Rich Plasma (PRP) therapy. The physical rehabilitation program is structured in three phases, tailored to the patient's condition, integrating therapeutic modalities such as TENS, therapeutic ultrasound, gentle massage, muscle strengthening exercises, proprioceptive exercises, and low-impact aerobic exercises. This gradual and measured rehabilitation approach, interdisciplinary collaboration, and active patient involvement successfully improved range of motion, muscle strength and joint stability, allowing the patient to return to his professional activities as a police officer with a better quality of life and minimal risk of re-injury.

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