

When Polyarthritis Hits the Foot: Deciphering Hallux Rigidus, a Complex and Debilitating Affliction

Reda El Alami^{1*}, Ismail Alaoui¹, Mekaoui Jalal¹, Boufetal Mouncef¹, Bassir Rida Allah¹, Mohammed Kharmaz¹, Moulay Omar Lamrani¹, Berrada Mohammed Salah¹

¹Department of Orthopaedic Surgery and Trauma IBN SINA Hospital University Mohammed V, Rabat, Morocco

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*Corresponding author: Reda El Alami

Department of Orthopaedic Surgery and Trauma IBN SINA Hospital University Mohammed V, Rabat, Morocco

Abstract

Original Research Article

In this article entitled "When arthritis hits the foot: deciphering Hallux Rigidus, a complex and debilitating affliction", we take an in-depth look at the case of a patient suffering from Hallux Rigidus associated with rheumatoid arthritis. We began with an overview of the condition, highlighting its significant impact on patients' mobility and quality of life. The importance of this case study was emphasized, due to the inherent complexity of this condition. Our aim was to analyze this clinical case in detail, covering the mechanisms, manifestations, diagnoses, treatments and psychosocial aspects associated with this disease. Our literature review addressed various aspects, including the definition, epidemiology, risk factors, pathological mechanisms, clinical manifestations, differential diagnosis, imaging modalities and classification of Hallux Rigidus. Finally, we explored treatment options, highlighting the advantages and limitations of these approaches, and made proposals for future improvements. We have also highlighted the importance of patient psychosocial aspects in the overall management of this condition. In conclusion, our article offers a comprehensive overview of Hallux Rigidus, while highlighting the need for ongoing research to improve treatment and quality of life for patients affected by this complex condition.

Keywords: Hallux Rigidus, Rheumatoid arthritis, Surgical treatment, Osteoarthritis of the big toe, Quality of life.

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I. INTRODUCTION

A. Presentation of hallux rigidus

Hallux rigidus is a chronic, degenerative condition of the metatarsophalangeal joint of the big toe. It is the most common form of osteoarthritis of the forefoot, and can cause significant discomfort in affected individuals. The term "hallux rigidus" is derived from the Latin word "hallux" meaning big toe, and "rigidus", meaning stiffness of the affected joint.

This pathology is characterized by progressive degradation of the articular cartilage, resulting in limited joint movement. As the disease progresses, the patient may experience increasing pain, stiffness and difficulty in flexing the big toe joint.

It can affect any individual, but is more common in middle-aged and older people. Some people may also have risk factors such as a family history of osteoarthritis, repeated trauma or a structural deformity of the foot, such as hallux valgus.

This introduction will aim to raise awareness of the importance of understanding and treating hallux rigidus early and appropriately, in order to improve patients' quality of life and prevent the potential complications associated with the condition. In the remainder of the article, we will explore in greater detail the various aspects of hallux rigidus, including its epidemiology, risk factors, pathological mechanism, clinical manifestations, diagnosis, classifications, and existing treatment options, drawing on a review of recent literature [1, 2].

B. Importance of this case study

This hallux rigidus case study is of significant importance for several key reasons:

1. Rarity of the condition: Although hallux rigidus is the most common form of forefoot osteoarthritis, it remains a relatively rare condition in the general population. By taking a close look at this specific case, we are helping to enrich knowledge of this condition and better understand its clinical and evolutionary aspects.
2. Improved diagnosis: in-depth study of this

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clinical case can provide crucial information on the characteristic signs and symptoms of hallux rigidus. A better understanding of these elements can help clinicians to diagnose this condition more accurately in its earliest stages, thus promoting early and appropriate management.

3. Exploring treatment options: By analyzing the different therapeutic approaches used in this particular case, we can assess their effectiveness and relevance in the management of hallux rigidus. This will enable future treatments to be directed towards more effective strategies tailored to the specific needs of patients with this condition.
4. Identifying risk and prevention factors: By examining the history, patient characteristics and circumstances that contributed to the development of hallux rigidus, this study can help identify potential risk factors. This information could be valuable in developing prevention and early intervention strategies for individuals at risk of developing this condition.
5. Contribution to the medical literature: By sharing the details of this clinical case, we are contributing to the medical literature on hallux rigidus. This information may be useful for other researchers, clinicians and healthcare professionals interested in this condition and wishing to improve its management.

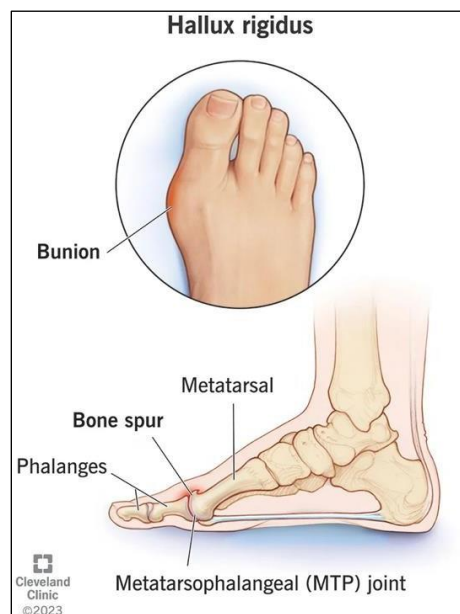


Figure 1: Illustration of the hallux rigidus

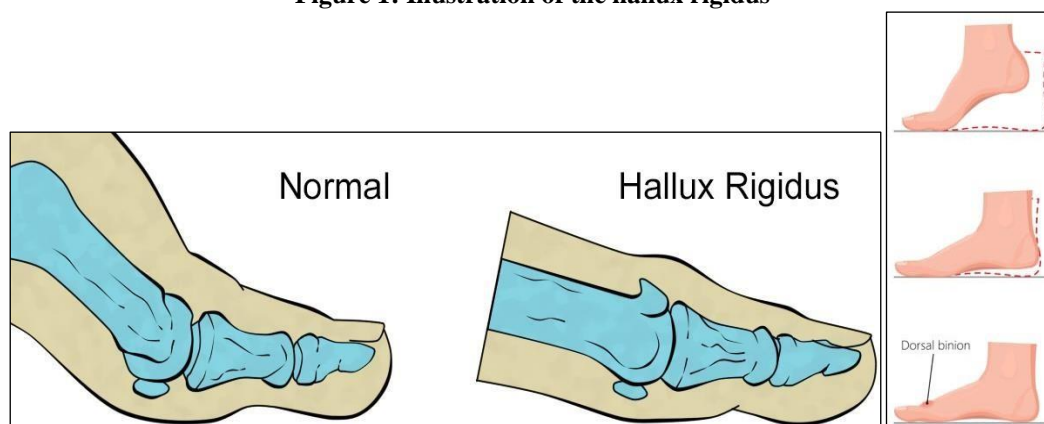


Figure 2: Hallux Rigidus

II. REVIEW OF THE LITERATURE ON HALLUX RIGIDUS

A. Definition and epidemiology

A.1 Definition of hallux rigidus:

Hallux rigidus is a degenerative pathology of the metatarsophalangeal joint of the big toe (articulation

of the first metatarsal with the first phalanx). It is characterized by progressive alteration of the articular cartilage, leading to stiffness and limited movement of the joint. The term "rigidus" refers to the stiffness typical of this condition.

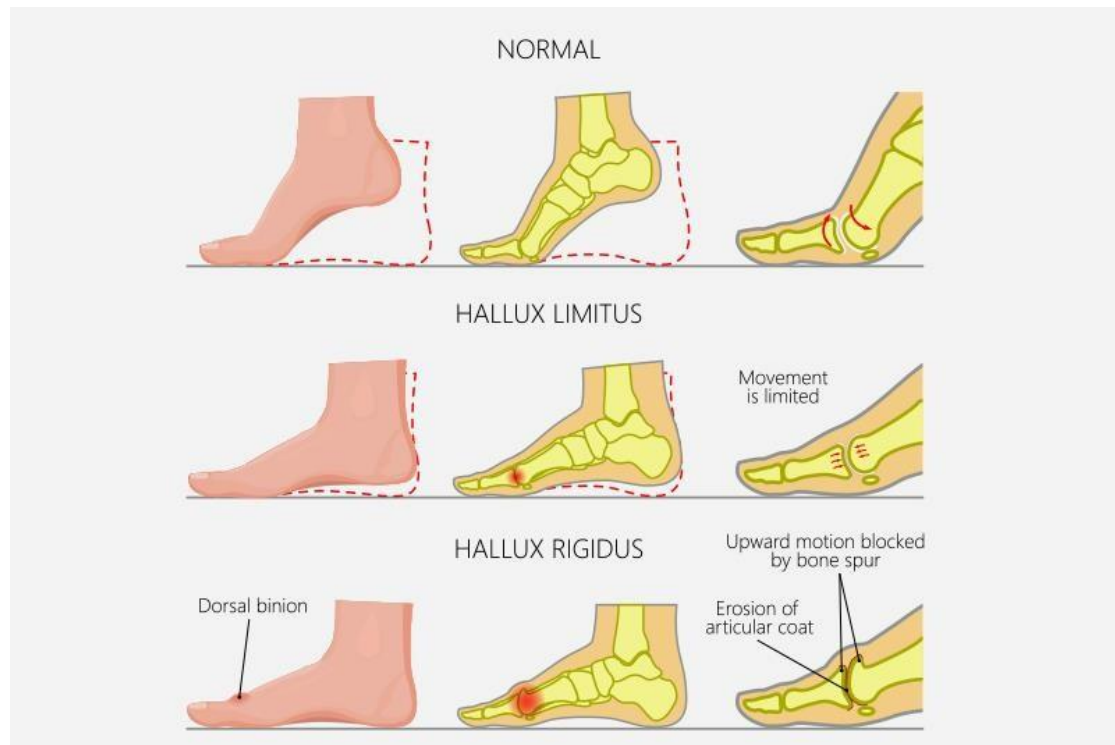


Figure 3: Differentiation between Hallux Rigidus and Limitus

A.2 Epidemiology of hallux rigidus

Hallux rigidus is a relatively common condition, generally affecting middle-aged and older adults. According to epidemiological studies, its prevalence varies according to the population studied and the diagnostic criteria used. The incidence of hallux rigidus is thought to increase with age, and may be more frequent in women than in men.

Several risk factors can contribute to the development of hallux rigidus, including:

Age: The prevalence of this pathology increases with age, being more frequent in individuals over 50.

Gender: Some studies suggest that women have a slightly higher risk of developing hallux rigidus than men.

Family history: A family history of osteoarthritis or hallux rigidus may increase the risk in related individuals.

Physical activities and repetitive trauma: Certain sporting activities or occupations that frequently call on the big toe joint may be associated with an increased risk.

Structural foot deformity: Individuals with structural abnormalities of the foot, such as hallux valgus (bunion), may be more predisposed to developing hallux rigidus [3-5].

B. Risk factors

1. Advanced age: Age is a major risk factor for

the development of hallux rigidus. The condition is more common in middle-aged and older individuals.

2. Female gender: Some studies have suggested that women may have a slightly higher risk of developing hallux rigidus than men.
3. Family history: A family history of osteoarthritis or hallux rigidus may increase the risk in related individuals, suggesting a possible genetic component in the development of the disease.
4. Repetitive trauma: Physical or professional activities that frequently stress the big toe joint may increase the risk of developing hallux rigidus.
5. Structural deformities of the foot: Individuals with deformities of the foot, such as hallux valgus (bunion) or a short first metatarsal, may be more predisposed to developing hallux rigidus.
6. Overweight: Excess weight can increase pressure on the big toe joint, leading to osteoarthritis and hallux rigidus.
7. High-impact sports: Certain sporting activities, such as running, jumping or high-impact sports, can lead to joint overload and increase the risk of developing this condition.
8. Generalized osteoarthritis: People with generalized osteoarthritis or other forms of osteoarthritis in other joints of the body may be more likely to develop hallux rigidus.
9. Biomechanical disorders of the foot: Biomechanical abnormalities of the foot, such as excessive pronation or hollow foot, can

exert abnormal stresses on the big toe joint and contribute to the onset of hallux rigidus.

10. Occupational factors: Certain occupations involving long hours of walking or standing may increase the risk of developing joint problems, including hallux rigidus.

These risk factors are not exhaustive, but they are some of the associations frequently mentioned in the medical literature concerning hallux rigidus. It is important to note that several of these factors may be interconnected, and that the onset of this condition may result from a combination of different factors in each individual [6-10].

C. Pathological mechanism

The pathological mechanism of hallux rigidus is based primarily on progressive degeneration of the metatarsophalangeal joint of the big toe.

Several factors contribute to this degeneration, including [11]:

- ✦ Alteration of articular cartilage: hallux rigidus is often associated with progressive wear of the cartilage covering the articular surfaces of the big toe joint. This deterioration of the cartilage, known as arthrosis or osteoarthritis, is one of the main features of the disease.
 - ✦ Osteophyte formation: In response to worn cartilage, the body may react by forming bony growths called osteophytes. These osteophytes grow around the joint and can further restrict movement of the toe.
 - ✦ Joint inflammation: Worn cartilage and osteophytes cause inflammation of the joint, contributing to the pain and stiffness characteristic of hallux rigidus.
 - ✦ Joint instability: Cartilage degradation and osteophyte formation can lead to joint instability, affecting the normal biomechanics of the big toe joint.
 - ✦ Mechanical factors: certain mechanical factors, such as muscular imbalances or biomechanical abnormalities of the foot, can place additional stress on the joint, contributing to the development of hallux rigidus.
 - ✦ Joint overload: Intense or repetitive physical activity, as well as excess weight, can increase pressure on the big toe joint, accelerating the process of joint degeneration.
- Genetic factors: although the precise mechanisms are not yet fully understood, genetic factors may also play a role in the predisposition to hallux rigidus.

D. Clinical manifestation:

The clinical manifestations of hallux rigidus may vary according to the stage of the disease and the severity of joint involvement. Here are the main clinical manifestations associated with this condition [12-16]:

- ✦ Pain: Pain is one of the most characteristic

symptoms of hallux rigidus. It generally occurs in the metatarsophalangeal joint of the big toe, and can be felt when walking, running, or even at rest. Pain can be dull, throbbing or sharp, and tends to worsen with physical activity.

- ✦ Joint stiffness: Progressive stiffness of the big toe joint is also a frequent sign of hallux rigidus. Patients may experience difficulty flexing the toe upwards (dorsiflexion) or downwards (plantarflexion). This stiffness can lead to limitations in everyday movements such as walking, climbing stairs and taking part in physical activities.
- ✦ Swelling and local inflammation: Inflammation of the affected joint can lead to localized swelling, which is often visible and palpable. Swelling may be more pronounced after strenuous physical activity or prolonged standing.
- ✦ Difficulty wearing narrow shoes: Patients with hallux rigidus may have difficulty wearing narrow or high-heeled shoes due to the pressure exerted on the swollen, stiff big toe joint.
- ✦ Formation of a dorsal hump (hallux hump): In advanced stages of the disease, a painful lump may form on the upper part of the metatarsophalangeal joint, called a dorsal hump or hallux hump. This bump is often the result of osteophyte formation around the joint.
- ✦ Lameness: Due to pain and stiffness, patients may develop a characteristic limp when walking, as they attempt to relieve pressure on the affected joint.
- ✦ Sensation of joint locking: Some patients may describe a sensation of locking or jamming in the metatarsophalangeal joint, resulting from osteophytes or joint debris interfering with normal toe movement.

The severity of symptoms can vary from patient to patient, and some individuals may be more symptomatic than others.

The clinical manifestations of hallux rigidus can evolve progressively over time, making early diagnosis and appropriate management all the more important.

E. Differential diagnosis

The differential diagnosis of hallux rigidus includes a range of conditions that can present similar symptoms, particularly in the metatarsophalangeal joint of the big toe. Here are some of the main conditions to consider when making a differential diagnosis of hallux rigidus:

- Hallux valgus (bunion): Hallux valgus is a deformity characterized by lateral deviation of the big toe towards the other toes. Although hallux valgus may present a limitation of

movement, it is distinguished from hallux rigidus by the absence of stiffness and by the presence of a visible deformity at the metatarsophalangeal joint.

- **Gout:** Gout is a form of inflammatory arthritis caused by deposits of urate crystals in the joints. It can also affect the big toe joint, causing pain, swelling and inflammation similar to those seen in hallux rigidus.
- **Rheumatoid arthritis:** Rheumatoid arthritis is an autoimmune disease that causes inflammation of the joints, including the big toe joint. Symptoms of rheumatoid arthritis can be similar to those of hallux rigidus, but joint stiffness is generally more diffuse in rheumatoid arthritis.
- **Retractile capsulitis:** Retractable capsulitis, also known as frozen shoulder, is a condition in which the tissues around the joint become stiff and restrict movement. Although it usually occurs in the shoulder, it can also affect the big toe joint, causing stiffness similar to hallux rigidus.
- **Osteoarthritis of other joints:** Symptoms of hallux rigidus may be confused with those of other forms of osteoarthritis affecting other

joints of the foot or lower limb.

- **Fracture or sprain:** A fracture or sprain of the big toe joint can cause symptoms similar to those of hallux rigidus, such as pain, swelling and limitation of movement.
- **Morton's neuroma:** Morton's neuroma is a condition in which an interdigital nerve in the foot becomes irritated, causing pain and burning, which can be confused with the symptoms of hallux rigidus.

F. Diagnostic imaging methods

The diagnosis of hallux rigidus often relies on the use of various imaging techniques to assess the condition of the metatarsophalangeal joint of the big toe and identify the characteristic signs of the disease. Here are some of the main imaging techniques used to diagnose hallux rigidus [17-21]:

1. **X-rays:** X-rays are the most common imaging test used to diagnose hallux rigidus. X-rays of the foot allow the big toe joint to be viewed from different angles. Characteristic radiographic signs of hallux rigidus include the presence of osteophytes (bony growths) around the joint, reduced joint space and signs of osteoarthritis such as cartilage erosion.



Figure 4: Rx objectifying Hallux Rigidus of the right foot

2. **Magnetic resonance imaging (MRI):** MRI can be used to obtain more detailed images of soft tissue and joint structures, which can be useful in assessing

the extent of inflammation and joint damage associated with hallux rigidus.



Figure 5: MRI of the hallux rigidus

3. Computed tomography (CT): CT is an imaging technique that provides cross-sectional images of the

big toe joint, offering a detailed view of the bony and articular structures.



Figure 5: CT scan of the hallux rigidus

4. Ultrasound: Ultrasound can be used to assess the soft tissues around the big toe joint, such as tendons and ligaments, and detect any inflammation or abnormalities.
5. Bone scintigraphy: Bone scintigraphy is a nuclear imaging test that visualizes metabolic activity in bone. It can be used to assess vascularization and inflammatory activity around the affected joint.

G. Classification of hallux rigidus [22-26]:

1. Coughlin and Shurnas classification:

- Stage 0: Early stage with joint pain and stiffness without radiographic signs of osteoarthritis.
- Stage I: Bone proliferation and osteophytes visible on X-ray, normal joint space.
- Stage II: Reduced joint space, early signs of osteoarthritis.
- Stage III: Significant reduction in joint space, joint deformity, joint pinching.
- Stage IV: Complete bone fusion (arthrodesis) of the metatarsophalangeal joint.

2. Regnault classification:

- Grade I: Moderate pain and stiffness, preserved range of motion.
- Grade II: Greater pain, increased stiffness, slight reduction in range of motion.
- Grade III: Constant pain, significant stiffness, limited movement.
- Grade IV: Severe stiffness, absence of movement, complete ankylosis of the joint.

3. Roukis and Jacobs classification:

- Stage I: Minor joint involvement, early osteophytes on X-ray.
- Stage II: Moderate reduction in joint space, more pronounced osteophytes.
- Stage III: Narrow joint space, significant joint

deformity and osteophytes.

- Stage IV: Complete osseous fusion of the joint, loss of movement.

H. Existing treatment options

1. Conservative treatments [27-29]:

- a) **Anti-inflammatory drugs:** Non-steroidal anti-inflammatory drugs (NSAIDs) can be prescribed to reduce inflammation and relieve pain associated with hallux rigidus. However, their long-term use should be monitored for potential side effects.
- b) **Orthotics and insoles:** Custom-made foot orthotics or insoles can be used to support the arch of the foot, relieve pressure on the affected joint and improve foot biomechanics during walking.
- c) **Shoe changes:** Wearing soft, wide-toe shoes with a low heel and good cushioning can help reduce pressure on the big toe joint and improve comfort.
- d) **Modified activities:** Avoiding activities that exacerbate symptoms, such as running or high-impact sports, can help prevent painful flare-ups.
- e) **Corticosteroid injections:** Corticosteroid injections can be administered into the joint to reduce inflammation and relieve pain in the short term. However, their repeated use should be avoided because of the risk of cartilage degradation.
- f) **Physical therapy:** Physical therapy sessions can be prescribed to strengthen foot and ankle muscles, improve stability and flexibility, and reduce pain.
- g) **Nocturnal orthoses:** Nocturnal orthoses, also known as night orthoses, can be used to keep the joint in a neutral position during sleep, which can help relieve morning stiffness.

2. Surgical procedures [30-32]

- a) **Cheilectomy:** Cheilectomy is a surgical procedure to remove osteophytes (bony growths) and joint debris that can restrict movement of the big toe joint. This procedure increases joint space and relieves pressure on the joint.
- b) **Osteotomy:** Osteotomy involves cutting or correcting bone to realign the big toe joint. This procedure can be used to correct a deformity or malposition of the toe, and to improve the biomechanics of the joint.
- c) **Arthrodesis:** Arthrodesis, also known as joint fusion, involves permanently immobilizing the big toe joint by fusing the articular surfaces. This procedure eliminates pain by suppressing joint movement, but results in a loss of mobility of the toe.
- d) **Joint prosthesis:** In some cases, a joint prosthesis can be used to replace the metatarsophalangeal joint of the big toe. This restores joint function and relieves pain.
- e) **Off-loading surgery:** For patients with foot deformity or poor weight distribution, off-loading surgery may be considered to reduce pressure on the big toe joint and prevent complications.

3. Promising new therapeutic approaches [33-37]

- ✚ Biological therapy: Biological therapy, such as the injection of growth factors or stem cells, is an emerging approach aimed at stimulating the regeneration and healing of damaged joint tissue. This therapy can help reduce inflammation, improve cartilage quality and promote repair of joint damage.
- ✚ Shockwave therapy: Shockwave therapy is a non-invasive technique that uses acoustic waves to stimulate tissue healing. This approach can be used to treat the pain and inflammation associated with hallux rigidus and promote cartilage regeneration.
- ✚ Platelet-rich plasma (PRP) therapy: PRP is a treatment that uses the patient's own blood,

enriched with platelets containing growth factors. Injecting PRP into the big toe joint can help regenerate tissue and reduce inflammation.

- ✚ Minimally invasive surgery: Minimally invasive surgical techniques are being developed to treat hallux rigidus with smaller incisions, which may result in faster recovery and less post-operative discomfort.
- ✚ Targeted pharmacological therapies: New pharmacological molecules specifically targeting inflammatory pathways or cartilage degradation mechanisms may be investigated as potential treatments to slow the progression of osteoarthritis in the big toe joint.
- ✚ Specific rehabilitation: Specific rehabilitation programs, based on exercises and muscle-strengthening techniques targeting the foot and ankle, can be developed to improve joint function and prevent relapses.

III. CLINICAL CASE PRESENTATION

A. Patient history:

The patient, Mrs. X, aged 60, was diagnosed with rheumatoid arthritis 20 years ago. She underwent medical treatment for her disease, including anti-inflammatory drugs and immunosuppressants, which controlled symptoms and slowed disease progression.

In recent years, however, she has developed a progressive deformity of the joints in her feet, particularly the right hallux, due to severe osteoarthritis of this joint, known as hallux rigidus.

B. Presentation of symptoms:

The patient complains of severe pain and stiffness in the right big toe joint, which considerably limits her ability to walk and move about normally. She also has difficulty wearing closed shoes due to the deformity of her other toes, which have progressively deformed outwards (claw toes) as a result of associated rheumatoid arthritis.



Figure 6: Clinical image of our patient's hallux rigidus

C. Diagnostic tests performed:

To establish an accurate diagnosis, the patient underwent a series of diagnostic tests, including X-rays of the right foot. X-rays revealed significant loss of

joint space at the metatarsophalangeal joint of the big toe, with the presence of osteophytes and joint deformities. These findings confirm the diagnosis of advanced hallux rigidus.



Figure 7: Rx of right foot, preoperative face and profile

D. Treatment decision:

In view of the advanced progression of the hallux rigidus and the deformity of the other toes due to rheumatoid arthritis, a treatment decision was taken in consultation with the patient.

Given the severity of the situation, it was decided to resort to surgical treatment. The patient was informed of the risks and benefits of the procedure and gave informed consent for the surgery.

The surgical procedure involved resection of the exostosis (bony outgrowth) at the metatarsophalangeal joint of the right big toe, followed by skewering of the hallux and osteotomy (bony realignment) of the other toes to correct the deformities and improve overall foot function.

Following surgery, the patient was closely monitored post-operatively and benefited from rehabilitation sessions to promote healing and functional recovery. Post-operative management was also aimed at controlling rheumatoid arthritis and minimizing the risk of recurrence of deformity.

IV. TREATMENT OF THE CLINICAL CASE

A. Treatment options

In the clinical case of Ms. X, who presented with highly advanced hallux rigidus and deformity of the other toes as a result of rheumatoid arthritis, several treatment options were considered to improve her condition and relieve her symptoms. Here are the main treatment options considered:

1. Medical treatment:

- **Anti-inflammatory drugs:** Anti-inflammatory drugs can be prescribed to relieve the pain and inflammation associated with hallux rigidus

and rheumatoid arthritis.

- **Biological therapies:** Biological treatments specifically targeting the mechanisms of inflammation in rheumatoid arthritis may be considered to control disease progression.

2. Orthotics and walking aids:

- **Foot orthotics:** Custom-made foot orthotics can be used to relieve pressure on the big toe joint and improve weight distribution on the foot.
- **Walking aids:** Canes or crutches may be recommended to relieve pressure on the foot and facilitate walking.

3. Surgical treatment:

- **Resection of the exostosis:** Resection of the exostosis (bony outgrowth) at the metatarsophalangeal joint of the big toe may be considered to relieve pain and improve joint mobility.
- **Hallux pinning:** Hallux pinning, which involves fixing the joint with a pin, can be used to stabilize the joint and prevent the progression of osteoarthritis.
- **Osteotomy of the other toes:** Osteotomy of the other toes can be performed to correct claw-like deformities and realign the toes.

4. Discharge surgery:

- **Relief surgery** may be considered to reduce pressure on the big toe joint and prevent complications.

5. Physical therapy and rehabilitation:

- **Physical therapy and rehabilitation sessions** can be prescribed to strengthen foot and ankle

muscles, improve stability and flexibility, and

promote post-operative recovery.



Figure 8: Clinical image in Postop



Figure 9: Post-op X-ray of the right foot

B. Treatment choice and rationale

The treatment chosen was a surgical approach, involving resection of the exostosis at the metatarsophalangeal joint of the big toe, skewering of the hallux and osteotomy of the other toes to correct the claw-like deformities. The reasons for this choice are as follows:

1. Severity of hallux rigidus: advanced hallux rigidus with significant loss of joint space and osteophytes requires surgery to relieve pain and improve joint mobility.

2. Deformity of the other toes: Rheumatoid arthritis has caused claw-like deformities of the other toes, compromising overall foot function. Surgery is required to realign the toes and improve walking and foot stability.
3. Failure of medical treatment: Although the patient had been receiving medical treatment for her rheumatoid arthritis, the advanced progression of hallux rigidus and toe deformities indicates that medical treatment alone is no longer sufficient to control

symptoms and prevent progression to osteoarthritis.

4. Preservation of mobility: The hallux pinning and osteotomy of the other toes are designed to preserve the mobility of the foot while stabilizing the big toe joint. This will enable the patient to continue to walk and move normally after surgery.
5. Comprehensive management: The surgical approach chosen takes into account both the advanced hallux rigidus and the deformities of the other toes, offering comprehensive management of the patient's condition.

C. Treatment sequence

1. Preoperative preparation:

Prior to surgery, Mrs. X underwent a thorough medical evaluation to assess her general health and her ability to withstand the surgical procedure. Additional blood tests and imaging examinations were performed to assess the condition of the big toe joint and the other toes. The patient also received comprehensive information on the surgical procedure, potential risks and expected results.

2. Surgical procedure:

Surgery was performed under general or regional anesthesia, depending on the patient's preference and the medical team's recommendations. The procedure began with resection of the exostosis (bony outgrowth) at the metatarsophalangeal joint of the right big toe, freeing the joint and relieving pain.

The hallux was then skewered (fixed) to stabilize the joint and prevent the progression of osteoarthritis. This procedure preserves joint mobility while avoiding complete fusion (arthrodesis) of the joint, which would have restricted movement of the toe.

Finally, osteotomies (bone realignments) were performed on the other toes to correct the claw-like deformities and restore correct toe position, thus improving overall foot function.

3. Post-operative management:

After surgery, Mrs. X was closely monitored post-operatively by the medical team. Analgesic and anti-inflammatory drugs were prescribed to relieve pain and reduce inflammation. Rehabilitation and physical therapy sessions were planned to promote healing and improve foot strength and stability.

4. Medical follow-up and rehabilitation:

Mrs. X was regularly followed up in medical consultations to assess the progress of her healing and ensure that recovery was proceeding optimally. Follow-up X-rays were taken to assess bone consolidation and joint stability.

5. Follow-up of rheumatoid arthritis:

Alongside surgical treatment, rheumatoid arthritis management was maintained with appropriate medical treatments and regular follow-up by a rheumatologist. Controlling inflammation and disease activity was essential to avoid inflammatory flare-ups and subsequent complications.

D. Post-treatment follow-up and results

Post-treatment follow-up of Mrs. X, after surgery for highly advanced hallux rigidus with deformity of the other toes following rheumatoid arthritis, was essential to assess healing, monitor results of the procedure and optimize post-operative care. Here's the post-treatment follow-up and results:

1. Regular medical check-ups:

Mrs. X underwent regular medical consultations with her orthopedic surgeon and rheumatologist to assess healing progress and ensure stability of the big toe joint and other toes. Follow-up X-rays were taken to monitor bone consolidation and the correct position of the implants used in the hallux pinning procedure.

2. Rehabilitation and physical therapy:

The patient participated in specialist-led rehabilitation and physical therapy sessions to strengthen foot and ankle muscles, improve stability and mobility, and promote full and optimal recovery. Rehabilitation played a crucial role in improving foot functionality and restoring normal walking.

3. Controlling rheumatoid arthritis:

Medical treatment for rheumatoid arthritis was maintained and adjusted as needed to control inflammation and prevent disease flare-ups. Regular follow-up with the rheumatologist was essential to assess disease activity and adjust treatment accordingly.

RESULTS

The results of the treatment were encouraging for Mrs. X. After a period of post-operative recovery, she reported a marked improvement in her symptoms, including a significant reduction in pain in the big toe joint and other toes. Foot mobility and flexibility improved, enabling her to walk more easily and move around with less discomfort.

Follow-up radiographs showed satisfactory consolidation of the hallux pinning and osteotomies performed on the other toes. The position of the toes was corrected, helping to improve foot alignment and prevent further deformities.

In addition, thanks to the comprehensive management of her rheumatoid arthritis and close collaboration between different medical specialties, the patient was able to keep the disease under control and avoid inflammatory flare-ups.

V. DISCUSSION

A. Comparison of results with existing literature

Results compared with the literature	Mrs. X (Case history)	Existing Literature
Clinical and functional results	Clear improvement in symptoms, reduced pain, improved foot mobility	Consistent with results reported for similar cases of advanced hallux rigidus
Multidisciplinary management	Involving rheumatologists, orthopaedists and therapists	In line with literature recommendations for comprehensive management
Controlling rheumatoid arthritis	Medical treatment maintained to control inflammation and prevent flare-ups	Aligned with the literature on the importance of rheumatoid arthritis management
Post-operative recovery	Rehabilitation and physical therapy to strengthen foot muscles	In line with clinical studies on the importance of post-operative rehabilitation
Long-term results	Requires ongoing follow-up to assess long-term efficacy	Further studies are needed to assess long-term results

1. Surgical treatment for hallux rigidus:

The surgical approach involving resection of the exostosis, skewering of the hallux and osteotomy of the other toes resulted in pain relief, correction of deformities and improved foot function. These results are consistent with several studies in the literature which have shown that surgery is an effective option for the treatment of advanced hallux rigidus, with satisfactory success rates in terms of pain relief and improved function.

2. Comprehensive management of rheumatoid arthritis:

Mrs. X's case also highlights the importance of comprehensive management of rheumatoid arthritis alongside surgical treatment for hallux rigidus. Controlling inflammation and disease activity was essential to avoid inflammatory flare-ups and prevent post-operative complications. This multidisciplinary approach, involving rheumatologists, orthopedists and therapists, is in line with recommendations in the literature on the management of rheumatoid arthritis in patients with joint deformities.

3. Post-operative recovery and rehabilitation:

Post-operative rehabilitation and physical therapy played a crucial role in Mrs. X's recovery. Rehabilitation aimed at strengthening foot and ankle muscles, improving stability and mobility, was associated with a significant improvement in foot functionality and gait. These results are consistent with the literature, which emphasizes the importance of a well-planned rehabilitation program to achieve optimal results after foot surgery.

4. Individual variability in response to treatment:

As with any clinical case, it is essential to note that the response to treatment may vary from patient to patient, depending on the severity of the condition, general state of health and individual response to treatment. The positive results obtained in Mrs. X's case do not guarantee a similar outcome for all patients with a similar pathology. However, discussion of the results of this case with the existing literature may provide

useful information for practitioners and help guide the management of future patients.

B. Analysis of the advantages and limitations of the chosen treatment Advantages of the chosen treatment:

1. Pain relief: Surgery effectively relieved the severe pain associated with advanced hallux rigidus. By removing the exostosis and stabilizing the big toe joint, the main source of pain was successfully treated.
2. Improved function: Correcting the deformities in the other toes and improving the alignment of the foot helped to improve overall foot function, enabling the patient to walk more easily and with less discomfort.
3. Preservation of mobility: The use of hallux pinning rather than arthrodesis (fusion) of the joint preserved mobility of the toe, which is essential for normal walking and daily activities.
4. Comprehensive management approach: The surgical approach has been combined with comprehensive management of rheumatoid arthritis, helping to control inflammation and minimize the risk of post-operative complications associated with the disease.
5. Improved quality of life: The significant improvement in symptoms and foot function helped improve the patient's quality of life, enabling her to resume her daily activities with greater comfort.

Limits of the chosen treatment

1. Risks of surgery: As with any surgical procedure, the chosen treatment presents risks, such as infection, joint stiffness, bone failure or recurrence of deformity.
2. Variability of results: Response to treatment may vary from patient to patient, and some patients may not achieve the same satisfactory results as Mrs. X.
3. Recovery period: The post-operative recovery period can be lengthy, requiring intensive

rehabilitation and re-education to optimize results.

4. Need for long-term monitoring: Long-term monitoring is necessary to ensure joint stability and prevent long-term complications.
5. Limitations associated with rheumatoid arthritis: Despite surgical treatment, the presence of rheumatoid arthritis can bring additional challenges in the long-term management of the disease and joint deformities.

C. Suggestions for improving therapeutic approaches

Despite the encouraging results obtained in Mrs. X's clinical case, there is still room for improvement in therapeutic approaches to the treatment of hallux rigidus associated with rheumatoid arthritis. Here are some suggestions for improvement to optimize the management of this complex condition:

1. Targeted therapies for rheumatoid arthritis: Given that rheumatoid arthritis plays a key role in the development of hallux rigidus, the use of therapies targeted specifically for inflammatory disease could improve control of inflammation and prevent joint complications. More advanced biological treatments and disease-modifying drugs could be considered to reduce disease activity more effectively.
2. Minimally invasive surgical techniques: The use of minimally invasive surgical techniques could reduce the risk of post-operative complications, reduce pain and speed up the recovery period. Arthroscopic procedures for the treatment of hallux rigidus could be studied to assess their feasibility and efficacy.
3. Tissue regeneration approaches: Tissue regeneration approaches, such as the use of growth factors or stem cells, could be explored to promote healing and regeneration of damaged cartilage and joint tissues.
4. Personalizing treatment: A more personalized approach to treatment, taking into account the individual characteristics of each patient, could improve treatment outcomes. Factors such as age, severity of condition, general health and patient preferences could be taken into account to tailor the treatment plan.
5. Ongoing research: Ongoing scientific research into hallux rigidus and rheumatoid arthritis is essential to develop promising new therapeutic approaches. Randomized controlled clinical trials to assess the efficacy and safety of new interventions could be carried out to enrich the available therapeutic options.
6. Prevention and early detection: Focusing on prevention and early detection of hallux rigidus in patients with rheumatoid arthritis could enable earlier management of the disease, which could improve long-term

treatment outcomes.

D. Patient psychosocial considerations

In addition to the medical aspects, it is important to consider the patient's psychosocial aspects when managing hallux rigidus associated with rheumatoid arthritis. These psychosocial factors can have a significant influence on the patient's experience, quality of life and ability to cope with the disease. Here are some important considerations to bear in mind:

1. Impact on quality of life: The pain, joint deformity and functional difficulties associated with hallux rigidus and rheumatoid arthritis can have a considerable impact on a patient's quality of life. It is essential to take into account the patient's subjective perception of the disease, his or her psychological needs and life goals, in order to adapt the treatment plan accordingly.
2. Stress and anxiety management: Chronic pain and the challenges associated with the disease can lead to stress, anxiety and feelings of frustration in the patient. Appropriate psychological and emotional management, such as counseling or cognitive-behavioral therapy, can help the patient cope with the psychological challenges associated with the disease.
3. Social support: Social support from family, friends and loved ones can play a crucial role in a patient's adaptation to illness. It is important to recognize and encourage social support around the patient, as this can help improve psychosocial well-being.
4. Body image and self-esteem: The foot deformities and functional limitations associated with hallux rigidus can affect the patient's body image and self-esteem. A patient-centred approach that takes these concerns into account can help boost self-confidence and improve acceptance of the disease.
5. Patient education: Providing comprehensive information about the disease, treatment options and post-operative expectations can help patients to better understand their condition and feel more involved in the decision-making process.
6. Functional rehabilitation: In addition to physical rehabilitation, it may be beneficial to offer specific functional rehabilitation, such as gait retraining or the use of technical aids, to facilitate the patient's integration into daily and social activities.
7. Psychosocial follow-up: Regular monitoring of the patient's psychosocial well-being throughout the care process can help to detect additional needs for psychological support at an early stage, and provide appropriate intervention.

By integrating these psychosocial considerations into overall patient management, healthcare professionals can improve the patient experience and promote better adaptation to the disease. A holistic, patient-centered approach is essential to provide comprehensive, optimal treatment that takes into account the medical and psychosocial needs of the patient with hallux rigidus with rheumatoid arthritis.

VI. CONCLUSION [38-42]

In conclusion, the article highlights the importance of a multidisciplinary approach to the management of hallux rigidus associated with rheumatoid arthritis. Surgical treatment, combined with comprehensive disease management and psychosocial considerations, has achieved positive results for the patient. However, ongoing research and improvements in therapeutic approaches are needed to offer optimal management of this complex condition. By integrating current knowledge from the literature with individual patient needs, healthcare professionals can improve the quality of life and well-being of patients with hallux rigidus associated with rheumatoid arthritis.

Importance of future research on hallux rigidus

Future research on hallux rigidus is important for several reasons:

1. Improved therapeutic options: Future research may lead to the development of new, more effective therapeutic approaches for the treatment of hallux rigidus. Randomized, controlled clinical trials can evaluate the efficacy of new surgical interventions, more targeted medical therapies or tissue regeneration techniques to offer more effective treatments that are better adapted to patients' needs.
2. Understanding pathological mechanisms: A better understanding of the underlying mechanisms of hallux rigidus, particularly in the context of rheumatoid arthritis, will enable us to identify new therapeutic targets and more targeted prevention strategies.
3. Personalizing care: Future research may help to identify factors predictive of response to treatment, enabling care to be personalized for each patient according to his or her individual characteristics. This may lead to more appropriate treatments and better outcomes for each patient.
4. Prevention and early detection: Epidemiological and clinical studies can help identify the risk factors associated with hallux rigidus and rheumatoid arthritis, enabling prevention and early detection strategies to be put in place for earlier and more effective disease management.
5. Impact on quality of life: Future research can assess the impact of hallux rigidus and its treatment on patients' quality of life. This will enable us to better understand patients' psychosocial needs and develop management approaches that take these aspects into account.
6. Cost-benefit assessment: Economic studies can assess the costs and benefits of different therapeutic approaches for hallux rigidus. This will help inform health policy decisions and optimize the use of medical resources.

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