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Original article

The Importance of X-Rays and Laboratory Tests in Diagnosing Gout and the Role of Environmental Factors

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Abstract
Gout is an inflammatory arthritis characterized by deposition of monosodium urate crystals in joints due to hyperuricemia. This study explores the role of radiological imaging and blood tests in diagnosing gout among 175 patients at Al-Ajilat General Hospital and Polyclinic. Clinical, laboratory, and imaging data were analyzed using spectrophotometric uric acid assays and questionnaires from healthcare personnel. Results showed significant correlations between elevated uric acid levels, radiological findings of joint damage, and clinical symptoms. Males and elderly patients were more susceptible. The results also showed that the highest percentage was yes (62%) that X-rays are used to detect structural changes in bones and joints. The results showed that the highest response was advising patients to measure uric acid levels during follow-up as needed (76%). This is because after the condition stabilizes, the doctor may decide to reduce the frequency of tests, focusing on the patient's clinical symptoms, The results showed that winter is the season that most significantly affects gout, at a rate of (85%), because the cold reduces the solubility of uric acid in the joints, which facilitates its deposition in the form of crystals, especially in the extremities (such as the fingers and toes). Nonsteroidal anti-inflammatory drugs (NSAIDs) were the primary treatment during acute attacks, with diet and lifestyle modification recommended for long-term management. Radiology combined with blood testing enhances diagnostic accuracy and guides treatment, potentially preventing complications.
Keywords. Gout, Radiology, Blood Tests, Uric Acid, Diagnosis, Hyperuricemia.

Introduction

Gout is a prevalent and complex form of inflammatory arthritis characterized by the deposition of monosodium urate (MSU) crystals in joints and periarticular tissues, resulting from prolonged hyperuricemia. The condition classically manifests as acute, excruciatingly painful flares, most commonly affecting the first metatarsophalangeal joint (podagra), though it can involve other joints such as the knees, ankles, and wrists over time. Without proper management, recurrent gout attacks can progress to chronic tophaceous gout, leading to irreversible joint damage, deformity, and functional impairment [1].

Historically termed the "disease of kings," gout has long been associated with excessive consumption of purine-rich foods (e.g., red meat, seafood) and alcohol, particularly beer and spirits. However, modern epidemiological studies reveal a more nuanced picture, implicating genetic predisposition, metabolic syndrome, obesity, hypertension, and renal dysfunction as significant contributors to hyperuricemia and gout pathogenesis [2]. The rising global prevalence of gout parallels the increasing burden of metabolic diseases, underscoring the need for improved diagnostic and therapeutic strategies.

Accurate diagnosis of gout relies on a combination of clinical evaluation, laboratory testing, and advanced imaging. While the gold standard remains the identification of MSU crystals in synovial fluid via polarized light microscopy, this method is invasive and not always feasible in routine practice. Serum uric acid measurement, though widely used, has limitations, as hyperuricemia alone does not confirm gout, and uric acid levels may be normal during an acute attack [3]. Consequently, imaging modalities have become indispensable in the diagnostic workflow. Conventional radiography may reveal late-stage features such as erosions with overhanging edges and joint space narrowing, but early gout often presents with normal X-rays. Ultrasound demonstrates characteristic findings like the "double-contour sign" (urate deposition on cartilage) and tophi, while dual-energy CT (DECT) excels in detecting urate deposits with high specificity. MRI, though less commonly used, provides detailed assessment of soft tissue and bone involvement in complex cases [4]. This research aims to achieve the following: Identify and understand factors influencing the development and exacerbation of the disease symptoms, and determine early diagnosis and appropriate treatment to prevent relapses or serious complications.

Methods

Study Design and Population

A descriptive-analytical study was conducted from January 15 to March 15, 2025, including 175 subjects aged 25-69+, both male and female, from Al-Ajilat General Hospital and Polyclinic.

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Data Collection
Questionnaires were distributed to 105 healthcare providers (doctors, specialists, consultants). Seventy blood samples were collected from patients aged 30-73 for serum uric acid measurement.

Sample Processing
Venous blood (5 ml) was collected, centrifuged, and analyzed immediately using a Spectrophotometer 4040. Uric acid levels were compared with normal reference values (3.6–8.3 mg/dL).

Imaging
Patients underwent X-ray and ultrasound imaging to assess joint changes, including crystal deposits and bone erosions.

Ethical Considerations
All procedures followed institutional ethical guidelines with informed consent from participants.

Results
The results showed that the highest percentage was with doctors (96%). This may be due to the general nature of medicine: the general practitioner or family doctor is the starting point for any patient suffering from a health problem. These doctors treat a variety of diseases and refer patients to specialists when the problem is complex.

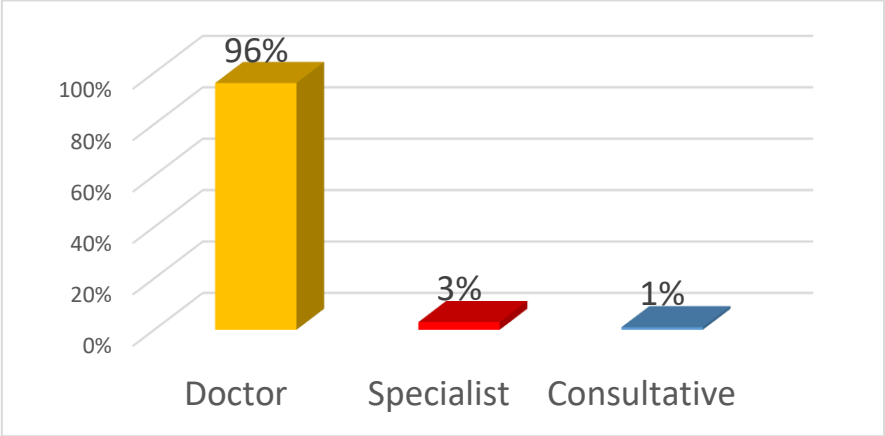

Figure 1. Characteristics of the personnel working inside the healthcare facility

The results showed that the incidence of gout is similar for men and women. This may be due to men being more susceptible to gout than women, especially after puberty, because they naturally have higher levels of uric acid. Women, on the other hand, have a lower incidence before menopause, due to the effect of estrogen, which helps eliminate uric acid through the kidneys. However, after menopause, their incidence rates increase, narrowing the gender gap at an older age.

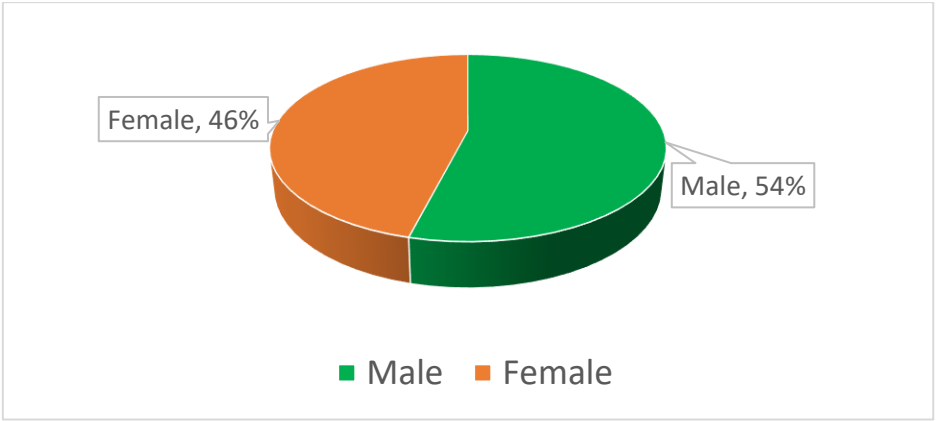

Figure 2. The gender most susceptible to gout

The results also showed that the highest age group was the elderly, and this may be due to the decreased efficiency of the kidneys in getting rid of uric acid with age, and the increased incidence of chronic diseases.

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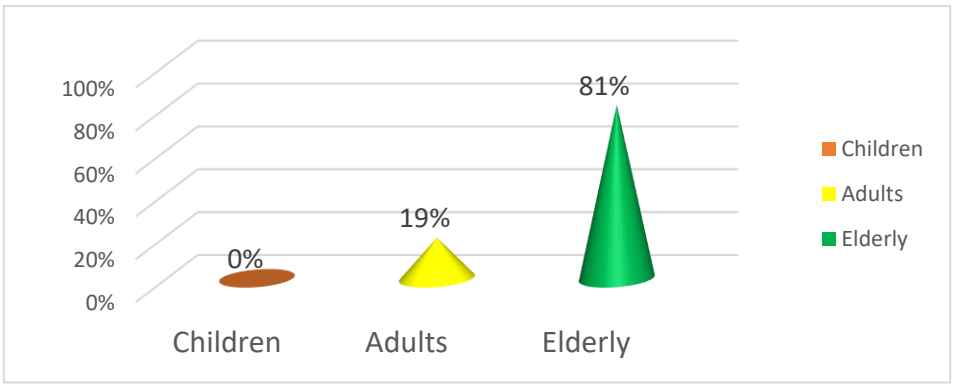

Figure 3. The age most susceptible to gout

Clinically, gout most frequently manifests in the big toe, which is the primary site of affliction in 60% of cases. Other joints like the ankle and knee are affected less often. The most common symptom leading to a diagnosis is the visible sign of redness and swelling in the joint, reported in 66% of instances. Diagnostic imaging, such as X-rays or ultrasound, supports the diagnosis by revealing structural changes or crystal deposits in 62% of cases, confirming the physical manifestation of the disease.

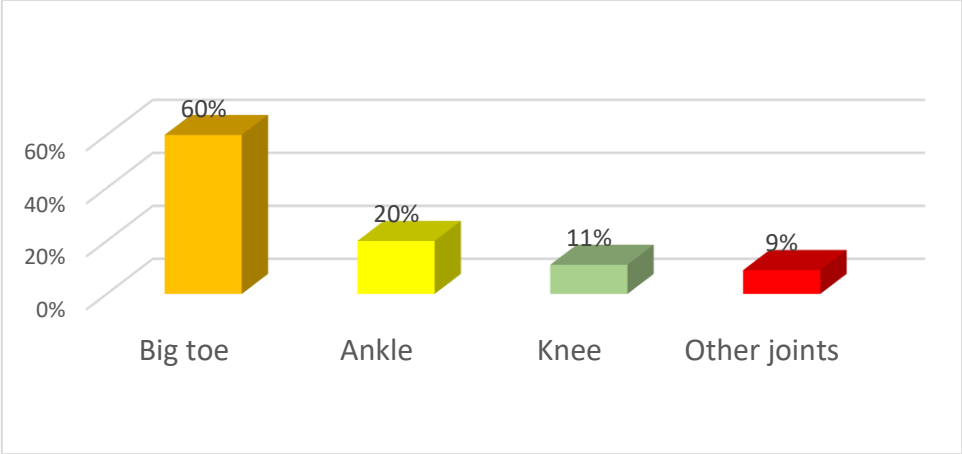

Figure 4. The joint is most susceptible to gout

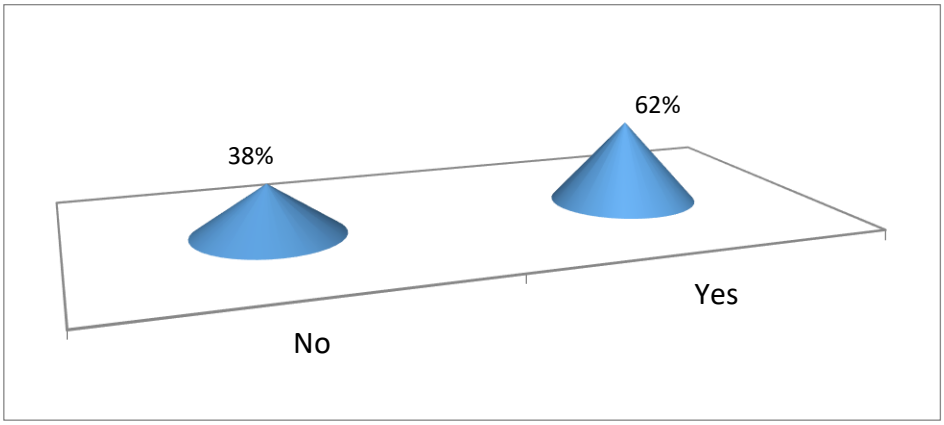

Figure 5. Do X-rays or ultrasound imaging show structural changes or crystal deposits

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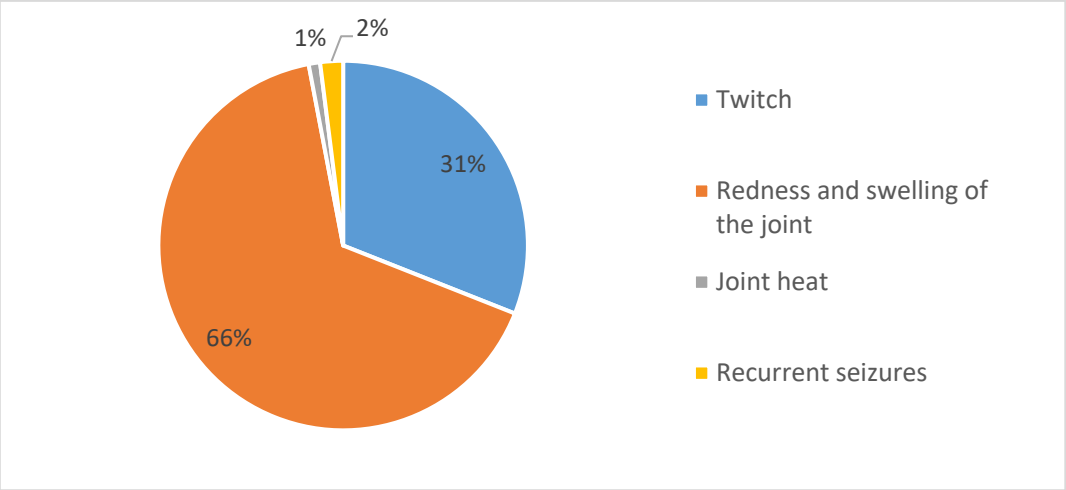

Figure 6. The most common clinical symptoms used for diagnosis

When it comes to treatment, the approach is twofold, addressing both acute attacks and long-term management. For immediate relief from acute gout attacks, the vast majority of patients (82%) are treated with nonsteroidal anti-inflammatory drugs (NSAIDs). For long-term control, the cornerstone of the management plan is diet and lifestyle modification, which is recommended for 83% of patients. This emphasis on lifestyle highlights a preventative and holistic approach to managing the chronic aspects of the disease. Uric acid-lowering medications are a secondary, though still significant, part of long-term strategy for 14% of patients.

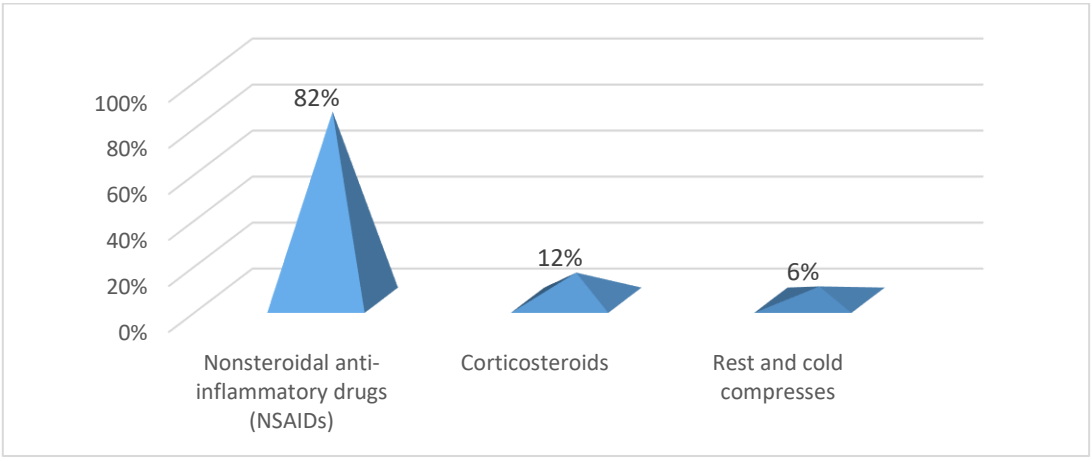

Figure 7. The most common step in treating acute gout attacks

Despite these established treatment protocols, healthcare providers face significant challenges. The most prominent obstacle, cited in 71% of responses, is patients' non-compliance with their prescribed medications. This suggests a critical gap between prescribing treatment and ensuring patient adherence. Furthermore, the data reveals interesting perceptions and external factors related to the disease. A substantial 70% of respondents believe that gout is not a hereditary condition. Additionally, the condition appears to have a seasonal component, with an overwhelming 85% of responses indicating that winter is the season that most affects gout.

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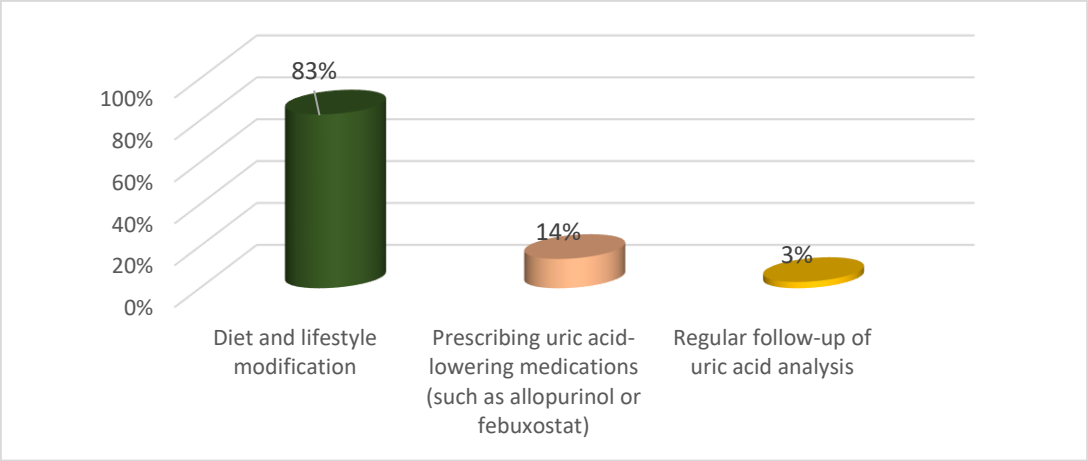

Figure 8. The most common plan for long-term disease management

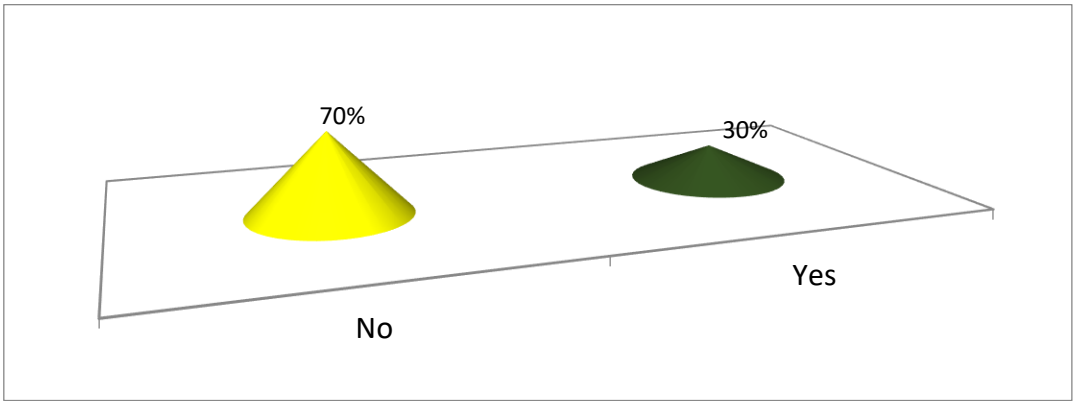

Figure 9. Is gout a hereditary disease

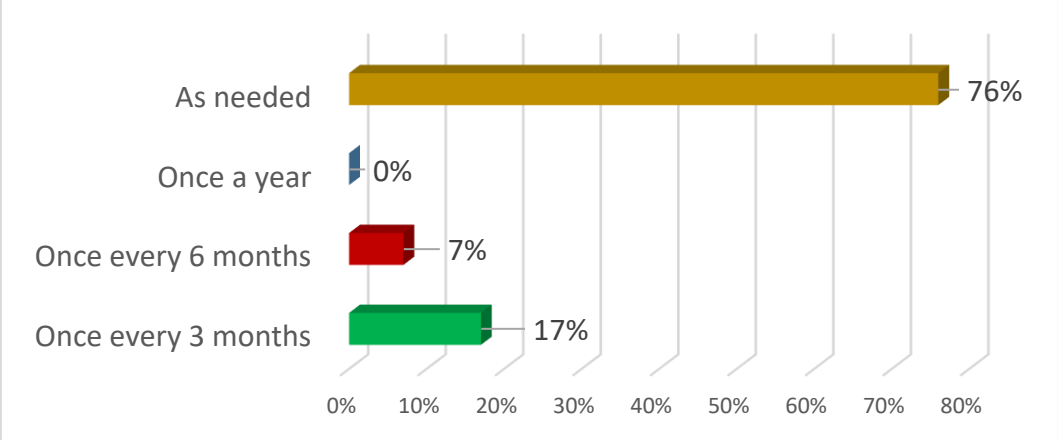

Figure 10. Advise patients to measure uric acid levels during follow-up.

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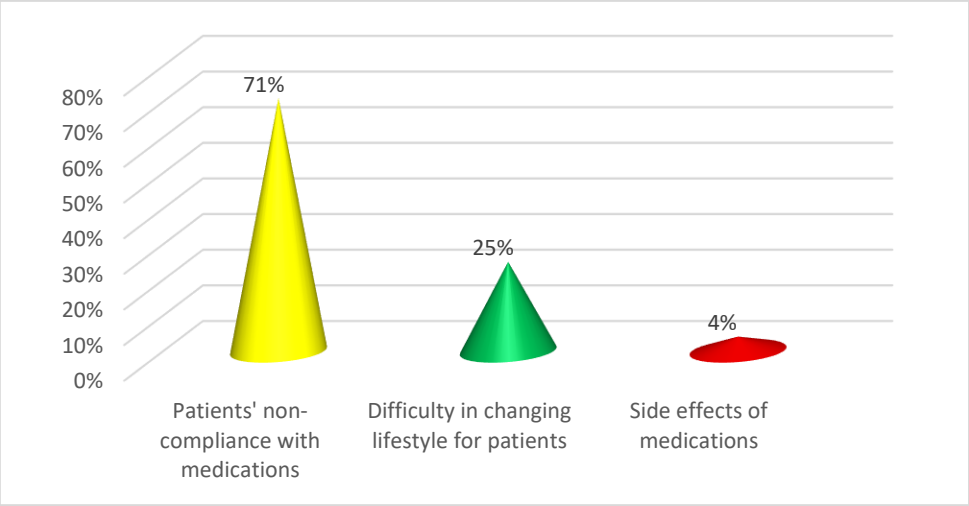

Figure 11. Challenges faced in treating patients

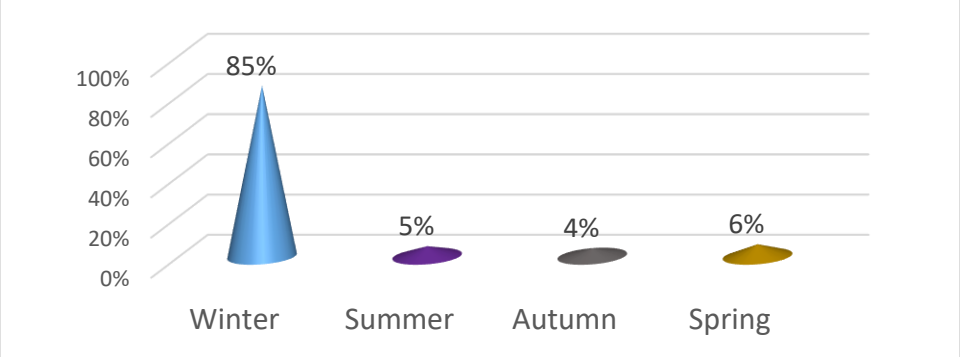

Figure 12. The seasons that affect gout the most

The results showed that the highest percentage of samples were (normal) and not infected with gout. This is because a high percentage of normal samples without gout is a positive indicator, as it indicates that most individuals do not suffer from high levels of uric acid in the blood, which is the main factor causing this disease. Gout occurs when uric acid crystals accumulate in the joints, leading to inflammation and severe pain associated with gout attacks.

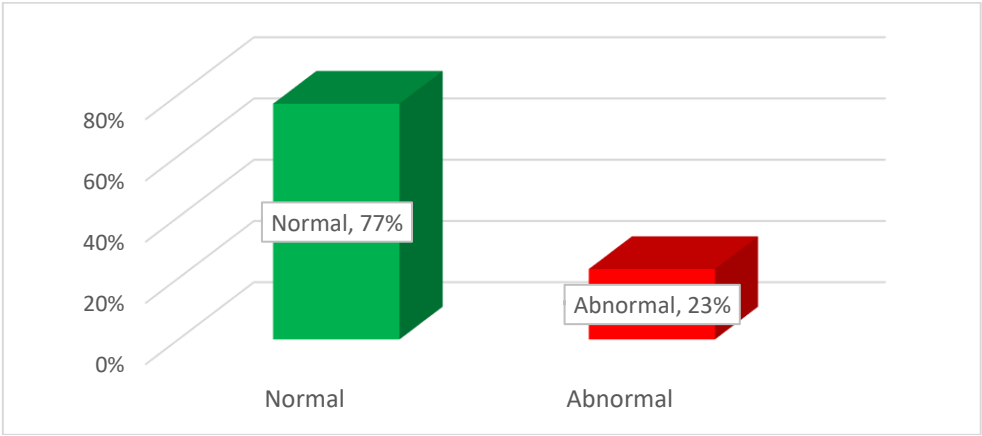

Figure 13. The distribution of samples according to gout infection (Uric acid test)

The results also showed that the highest age group was (52) and above, and it was similar to the answers to the questionnaire directed to internal medicine doctors and specialists. The reason for this may be that the age group was elderly, and the kidneys' efficiency in getting rid of uric acid may decrease with age, and the rate of chronic diseases increases.

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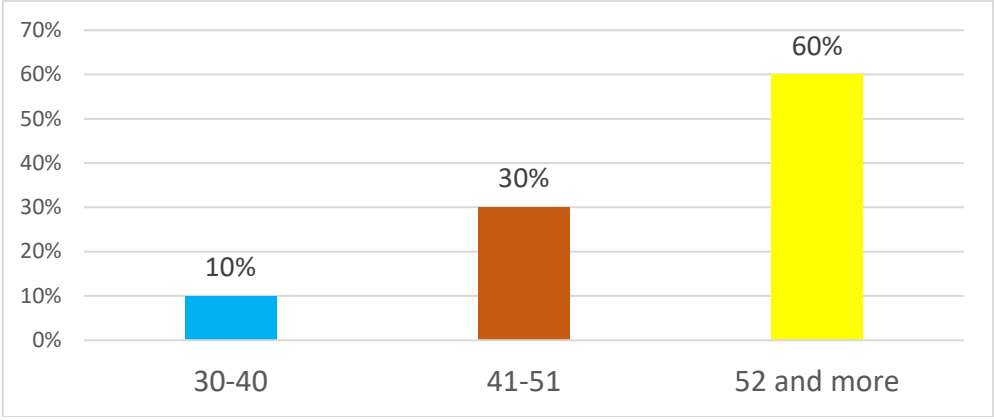

Figure 14. The distribution of samples of infected patients by age group

The results showed that the rate of gout is higher in males than in females (64%). This may be because males tend to consume larger quantities of red meat, foods rich in purines, alcoholic beverages, and soft drinks sweetened with fructose, which increase uric acid levels.

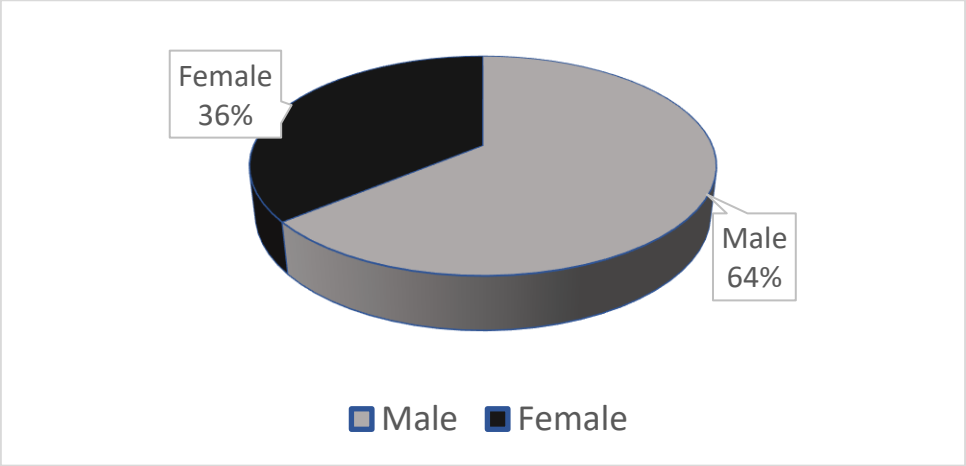

Figure 15. The distribution of infected samples by gender

Discussion

Gout remains one of the most prevalent forms of inflammatory arthritis, with a well-documented predilection for male and elderly populations [5]. This demographic pattern aligns closely with known physiological changes, particularly the age-related decline in renal uric acid clearance, compounded by lifestyle factors such as dietary habits and alcohol consumption. The disease's rising global prevalence, especially in industrialized nations, reflects its strong association with metabolic syndrome, obesity, and cardiovascular comorbidities [6]. Recent epidemiological data from the United States and New Zealand highlight striking disparities, with prevalence rates reaching 6.8% in the general U.S. population and as high as 10% among indigenous Māori communities, underscoring the complex interplay of genetic and environmental factors in gout pathogenesis [7,8].

The diagnostic landscape for gout has evolved significantly with advancements in radiological imaging, which now plays a complementary role alongside traditional laboratory testing. While synovial fluid analysis demonstrating monosodium urate crystals remains the diagnostic gold standard, modern imaging modalities offer non-invasive alternatives with excellent sensitivity and specificity [9]. Ultrasound imaging has emerged as particularly valuable, capable of detecting the pathognomonic "double-contour sign" with a sensitivity of 96% and specificity of 73%. Dual-energy CT (DECT) provides even greater precision in quantifying urate deposits, boasting sensitivity and specificity ranges of 85-100% and 83-92% respectively. These technological advances have substantially improved diagnostic accuracy, especially in cases where joint aspiration proves challenging or when differentiating gout from other arthropathies such as calcium pyrophosphate deposition disease [10,11].

Effective management of gout requires a dual approach combining pharmacological intervention with lifestyle modification. Urate-lowering therapy, particularly allopurinol as first-line treatment, aims to maintain serum urate levels below the critical threshold of 6 mg/dL, thereby preventing crystal formation and subsequent inflammatory attacks [12]. However, the clinical benefits of these treatments are frequently undermined by poor patient adherence, with studies reporting compliance rates ranging from a concerning 20% to a still-suboptimal 70%. This adherence gap stems from multiple factors, including patient

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misconceptions about treatment duration, inadequate healthcare provider education about treat-to-target protocols, and the asymptomatic nature of hyperuricemia between acute flares [4,13].

The consequences of suboptimal gout management extend beyond recurrent painful attacks. Chronic untreated gout progresses to tophaceous deposits, joint destruction, and significant functional impairment. Moreover, the systemic effects of persistent hyperuricemia contribute to worsening renal function and increased cardiovascular risk [14]. These serious complications highlight the urgent need for improved patient education strategies and healthcare system interventions. Promising approaches include nurse-led management programs and pharmacist-mediated monitoring, which have demonstrated 30-50% improvements in medication adherence in clinical trials [15].

Looking forward, the field of gout management stands to benefit from several emerging developments. Personalized medicine approaches may help address racial and ethnic disparities in treatment outcomes, while artificial intelligence applications in imaging analysis promise to enhance diagnostic precision. Portable ultrasound devices could revolutionize point-of-care diagnosis, particularly in resource-limited settings. Perhaps most importantly, a paradigm shift in patient education - moving beyond simple dietary advice to comprehensive disease literacy programs - may finally overcome the persistent challenge of treatment non-adherence [16,17].

The current body of evidence, as reflected in recent studies, paints a clear picture: while significant progress has been made in understanding and diagnosing gout, substantial gaps remain in translating this knowledge into effective, long-term management for all patient populations. Future research must focus not only on developing better therapeutic agents but also on creating more effective implementation strategies to ensure that existing treatments reach their full potential in clinical practice. The integration of advanced diagnostic technologies with personalized treatment approaches and robust patient support systems offers the most promising path forward in addressing this ancient yet still challenging disease.

Conclusion

Radiology and blood tests are indispensable for accurate gout diagnosis and management. Their combined use improves disease understanding, informs treatment strategies, and helps prevent complications. Regular uric acid monitoring and imaging assessments should be integrated into clinical practice.

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