

ПРОБЛЕМЫ РАННЕЙ ДИАГНОСТИКИ УРОЛОГИЧЕСКИХ ЗАБОЛЕВАНИЙ

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Аннотация: Раннее выявление урологических заболеваний имеет решающее значение для улучшения исходов лечения пациентов, снижения расходов на здравоохранение и повышения качества жизни пациентов. Несмотря на прогресс в области медицинских технологий и диагностики, существуют несколько препятствий на пути раннего выявления урологических расстройств. В данной статье рассматриваются эти трудности, в частности, касающиеся состояний, связанных с пациентами, ограничений системы здравоохранения, неопределенностей в диагностике и возникающих сложностей в данной области.

Ключевые слова: урологические заболевания, ранняя диагностика, диагностические трудности, исходы лечения пациентов, системы здравоохранения, диагностическая неопределенность, барьеры для выявления заболеваний.

UROLOGIK KASALLIKLARNING ERTA DIAGNOSTIKASIDAGI MUAMMOLAR

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Аннотация: Урологик касалликларни ерта аниқлаш, bemorlarni davolash natijalarini yaxshilash, sog'liqni saqlash xarajatlarini kamaytirish va bemorlar hayot sifatini oshirishda hal qiluvchi ahamiyatga ega. Tibbiyot texnologiyalari va diagnostika sohasidagi rivojlanishlarga qaramay, urologik kasalliklarni ерта аниқlashda bir qator to'siqlar mavjud. Mazkur maqolada ushbu qiyinchiliklar, xususan, bemorlarga bog'liq holatlar, sog'liqni saqlash tizimining cheklovlari, diagnostikadagi noaniqliklar va ushbu sohada yuzaga kelayotgan murakkabliklar muhokama qilinadi.

Калит so'zlar: urologik kasalliklar, ерта diagnostika, diagnostikadagi qiyinchiliklar, bemorlarni davolash natijalari, sog'liqni saqlash tizimlari, diagnostikadagi noaniqliklar, kasalliklarni аниқlashdagi to'siqlar.

CHALLENGES IN EARLY DIAGNOSIS OF UROLOGICAL DISEASES

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Annotation: The early identification of urological diseases is crucial for enhancing patient outcomes, lowering healthcare expenses, and improving the quality of life for those impacted. Despite progress in medical technology and diagnostics, several obstacles remain in the early detection of urological disorders. This article examines these challenges, specifically addressing patient-related conditions, limitations of healthcare systems, uncertainties in diagnosis, and emerging complexities in the field.

Keywords: urological diseases, early diagnosis, diagnostic challenges, patient outcomes, healthcare systems, diagnostic uncertainty, disease detection barriers.

Introduction: Urological diseases encompass a diverse range of conditions that affect the urinary tract and male reproductive organs. These conditions include, but are not limited to, prostate cancer, bladder cancer, kidney stones, urinary tract infections (UTIs), benign prostatic hyperplasia (BPH), kidney cancer, testicular cancer, interstitial cystitis, and erectile dysfunction. Each of these conditions presents unique challenges in terms of diagnosis, management, and treatment.

Prostate cancer, one of the most common urological cancers, often progresses silently without symptoms, making early detection particularly challenging [9]. Bladder cancer, characterized by its tendency to recur, requires vigilant monitoring even after initial treatment [12]. Kidney stones, while typically not life-threatening, cause significant pain and can lead to complications if not promptly diagnosed and managed [19]. UTIs, common in both men and women, can lead to more severe kidney infections if not detected early, while BPH, prevalent among older men, can severely impact quality of life due to urinary symptoms. Kidney cancer, though less common, poses diagnostic challenges due to its often asymptomatic nature until advanced stages [21]. Testicular cancer, primarily affecting younger men, is highly treatable if detected early, but delayed diagnosis can lead to more complex treatments [20]. Interstitial cystitis, a chronic condition, often goes undiagnosed for years due to its overlapping symptoms with other urological issues, leading to prolonged patient suffering [15]. Erectile dysfunction, while often considered a quality-of-life issue, can be an early indicator of more severe underlying conditions, such as cardiovascular disease [2].

Early diagnosis of these urological diseases is crucial for effective management and treatment. Prompt identification allows for the implementation of targeted therapies, which can significantly improve patient outcomes, reduce the risk of complications, and, in many cases, offer curative treatment options. However, achieving timely diagnosis is fraught with challenges that span across patient behavior, healthcare system inefficiencies, diagnostic uncertainties, and the evolving complexities within the field of urology [22].

Patient behavior plays a critical role in the timely diagnosis of urological diseases. Factors such as reluctance to seek medical help due to embarrassment or fear, a lack of awareness about the symptoms, and cultural or socioeconomic barriers can lead to significant delays. Additionally, many urological conditions are

asymptomatic in their early stages, further complicating efforts to encourage early consultation and diagnosis [24]. Healthcare system inefficiencies, such as limited access to specialized care, insufficient screening programs, and poor coordination between primary care providers and specialists, exacerbate these challenges. In many regions, the lack of resources and specialized healthcare professionals leads to delayed referrals and prolonged waiting times, which can significantly impact the timely diagnosis and treatment of urological diseases.

Diagnostic uncertainties add another layer of complexity. Urological diseases often present with nonspecific symptoms that overlap with other conditions, making differential diagnosis challenging. Current diagnostic tools, while valuable, have limitations in sensitivity and specificity, which can lead to missed or incorrect diagnoses. Moreover, the development and adoption of new diagnostic technologies, such as advanced imaging techniques and biomarkers, are progressing but require further validation and integration into clinical practice [25]. The field of urology is also evolving with the emergence of new challenges, including the increasing prevalence of comorbidities in aging populations and the integration of advanced technologies such as artificial intelligence (AI) and machine learning in diagnostic processes [16].

These emerging complexities require ongoing adaptation and innovation within the field to ensure that early diagnosis remains achievable and effective. This article examines these key challenges in detail, providing a comprehensive overview of the factors contributing to delays in the early diagnosis of urological diseases. By exploring patient behavior, healthcare system inefficiencies, diagnostic uncertainties, and the impact of emerging complexities, the article aims to shed light on the areas where improvements can be made and to propose strategies for overcoming these obstacles to enhance early detection and patient outcomes in urology.

Patient-Related Challenges: One significant obstacle to the early diagnosis of urological diseases is patient-related factors. These factors encompass a range of issues, including psychological, cultural, and socioeconomic barriers that can prevent individuals from seeking timely medical attention [7]. The reluctance to seek medical help is often driven by embarrassment, particularly when dealing with conditions related to the urinary tract or reproductive organs.

Urological symptoms are frequently perceived as private or intimate, leading to discomfort in discussing them openly, even with healthcare providers. This reluctance is further compounded by fear—fear of a potentially serious diagnosis, fear of invasive diagnostic procedures, or fear of the social implications associated with certain urological conditions.

Another critical issue is the lack of awareness about the symptoms of urological diseases. Many individuals are unfamiliar with the early signs of conditions such as prostate cancer, bladder cancer, or kidney stones, which can lead to significant delays in seeking medical help. For instance, symptoms like frequent urination, blood in the urine, or pelvic pain might be dismissed as minor or attributed to other less serious conditions, resulting in missed opportunities for early diagnosis [23]. In the case of prostate cancer, which often presents without noticeable symptoms until it has progressed to more advanced stages, this lack of awareness can have particularly severe consequences, as early-stage cancer is typically more treatable.

The asymptomatic nature of many urological diseases in their early stages further complicates early diagnosis [4]. Prostate cancer, for example, is often detected only when it has already progressed, as initial stages may not produce any symptoms. This silent progression means that many men may unknowingly live with the disease for years, only discovering it when treatment options become more limited and outcomes less favorable. The same issue applies to other conditions, such as bladder cancer, where early symptoms can be subtle or mistaken for less serious issues, delaying diagnosis and treatment.

Cultural and socioeconomic factors also play a crucial role in shaping patient behavior and attitudes toward seeking medical care [13]. In certain cultures, discussing urological symptoms, particularly those related to sexual or reproductive health, is taboo. This cultural stigma can lead to significant delays in diagnosis, as individuals may feel too embarrassed or ashamed to seek help. Additionally, cultural beliefs and practices might influence how symptoms are perceived and managed, with some individuals opting for traditional or home remedies rather than seeking professional medical advice.

Socioeconomic status is another critical determinant of healthcare access and utilization [17]. Individuals with lower socioeconomic status often face multiple barriers to accessing healthcare, including

financial constraints, lack of health insurance, and limited availability of specialized urological care, especially in rural or underserved areas. Financial barriers can prevent patients from seeking timely medical attention or adhering to recommended follow-up appointments, while the lack of insurance coverage may lead to delays in diagnosis or treatment as patients navigate the complexities of paying for healthcare services out-of-pocket.

Moreover, the geographic distribution of healthcare resources can significantly impact access to specialized care. Rural and underserved areas often have fewer urologists and diagnostic facilities, leading to longer waiting times for appointments and increased travel distances for patients. These factors can discourage individuals from seeking care promptly, resulting in delayed diagnoses and poorer health outcomes [3]. Addressing these patient-related barriers requires a multifaceted approach that includes targeted public health initiatives, community outreach programs, and education campaigns. Public health initiatives should aim to raise awareness about the importance of early detection and the symptoms of urological diseases, particularly in communities where stigma or cultural barriers are prevalent. Education campaigns can help demystify urological conditions and reduce the fear and embarrassment associated with them, encouraging individuals to seek help earlier.

Community outreach programs can play a vital role in reaching underserved populations, providing education and resources to overcome socioeconomic barriers. These programs could include mobile clinics that bring specialized care to rural areas, financial assistance for low-income patients, and partnerships with local organizations to increase healthcare access. By reducing stigma, increasing awareness, and improving access to care, these efforts can help to mitigate the impact of patient-related factors on the early diagnosis of urological diseases, ultimately leading to better health outcomes and more timely interventions.

Healthcare System Limitations: The healthcare system itself presents several significant challenges to the early diagnosis of urological diseases [11]. These challenges are multifaceted and include insufficient screening programs, limited access to specialized urological care, and inadequate integration of care between primary care providers and specialists. Each of these issues contributes to delays in diagnosis, which can have serious implications for patient outcomes.

One of the most pressing issues is the lack of widespread and effective screening programs for urological conditions. For example, while prostate cancer is one of the most common cancers among men, routine screening for this disease is not universally implemented [6]. The prostate-specific antigen (PSA) test, which is a primary tool for early detection, is not consistently offered or utilized across all regions and healthcare systems. In areas where routine screening is not widely practiced, there is a noticeable increase in the number of advanced-stage prostate cancer cases at the time of diagnosis. This indicates that opportunities for early detection and intervention are being missed, leading to poorer prognoses and more aggressive treatment requirements. The lack of uniform screening guidelines and the debate over the benefits versus risks of screening further complicate this issue, resulting in inconsistent practices and outcomes across different healthcare settings [5]. Limited access to specialized urological care is another critical barrier to early diagnosis. In many regions, particularly in rural or underserved areas, there is a shortage of urologists and specialized diagnostic facilities. This scarcity of resources means that patients often face long waiting times for appointments, which can delay the diagnostic process. For instance, a patient presenting with early symptoms of bladder cancer in a rural area may have to wait weeks or even months for a specialist consultation or for access to advanced diagnostic imaging, such as a cystoscopy or MRI. These delays can result in the progression of the disease to more advanced stages, where treatment options may be more limited and less effective.

The fragmentation of care within the healthcare system also plays a significant role in delayed diagnoses. Typically, primary care physicians serve as the first point of contact for patients experiencing urological symptoms. However, the pathway from primary care to specialized urological care is often slow and inefficient. Referral processes can be cumbersome, with primary care providers sometimes lacking the necessary training or resources to promptly identify symptoms that warrant specialist intervention [8]. Additionally, the communication between primary care providers and urologists is often insufficient, leading to gaps in patient care. For example, a primary care physician might recognize the need for a referral to a urologist but face difficulties in securing a timely appointment, or there may be poor follow-up after the referral, resulting

in delays in initiating diagnostic tests or treatments. Moreover, the coordination of care between different levels of the healthcare system is frequently inadequate. Patients may undergo initial evaluations in primary care settings, but the results and subsequent management plans may not be effectively communicated to urologists or other specialists. This lack of coordination can lead to fragmented care, where important information is lost or overlooked, further delaying diagnosis and treatment. For instance, if a primary care physician orders a PSA test and the results are borderline, there may be uncertainty about whether to refer the patient to a specialist immediately or to continue monitoring in primary care, leading to indecision and delays. The challenges are compounded by systemic issues such as the underfunding of public healthcare systems in certain regions, which restricts the availability of advanced diagnostic tools and specialized care. In some healthcare systems, budget constraints lead to prioritization of resources for more immediate or acute healthcare needs, leaving preventive and screening programs underfunded and underutilized. This lack of resources can disproportionately affect marginalized populations, who may already face barriers to accessing healthcare due to socioeconomic factors, further widening the gap in early diagnosis.

Addressing these healthcare system challenges requires a comprehensive approach that includes the expansion of screening programs, improved access to specialized care, and better integration of services across different levels of care [5]. Expanding screening programs could involve the development of clear, evidence-based guidelines that ensure uniformity in screening practices across regions. This would help in identifying at-risk populations and ensuring they receive appropriate screenings at the right intervals. Improving access to specialized urological care might involve increasing the number of trained urologists and diagnostic facilities, particularly in underserved areas.

Telemedicine could also play a role in bridging the gap by allowing primary care providers to consult with specialists remotely, thus reducing wait times and improving the speed of diagnosis. Additionally, the development of multidisciplinary teams that include primary care physicians, urologists, and other specialists could improve coordination and communication, ensuring that patients receive timely and comprehensive care.

Diagnostic Uncertainties and Limitations:

Even when patients seek medical attention and have access to care, significant diagnostic challenges can impede early diagnosis of urological diseases [14]. These challenges arise from the complex and often subtle presentation of urological conditions, which frequently manifest with nonspecific symptoms that overlap with a variety of other disorders. This symptom overlap can make differential diagnosis particularly challenging, requiring clinicians to distinguish between multiple potential causes based on limited and often ambiguous clinical information.

Urological diseases often present with symptoms that are common to many conditions, complicating the diagnostic process [10]. For example, lower urinary tract symptoms (LUTS) such as frequent urination, urgency, nocturia, and weak urinary stream are hallmark symptoms of benign prostatic hyperplasia (BPH) [1]. However, these same symptoms can also be indicative of bladder cancer, urinary tract infections (UTIs), or even overactive bladder syndrome. The challenge for clinicians lies in accurately identifying the underlying cause of these symptoms, which requires a careful and thorough evaluation of the patient's history, risk factors, and additional diagnostic tests. In many cases, the nonspecific nature of symptoms can lead to misdiagnosis or delayed diagnosis, as initial treatments may target the wrong condition.

For instance, a patient presenting with LUTS may initially be treated for a UTI based on the presence of urinary frequency and urgency, but if the underlying issue is bladder cancer, valuable time may be lost before the correct diagnosis is made. Similarly, symptoms like hematuria (blood in the urine), which can be a sign of bladder cancer, kidney stones, or a simple UTI, necessitate further investigation to rule out malignancy [10]. However, if such symptoms are dismissed or not thoroughly investigated, early-stage cancers may be overlooked until they have progressed to a more advanced stage, where treatment becomes more challenging and outcomes less favorable.

Current diagnostic tools and biomarkers for urological diseases also have limitations that contribute to diagnostic uncertainty [6]. Imaging techniques such as ultrasound, CT scans, and MRI are invaluable in visualizing the urinary tract and detecting abnormalities. However, these imaging modalities are not infallible and may fail to detect early-stage diseases. For example, prostate cancer in its initial stages may not produce any visible changes detectable by standard

imaging techniques. Small or low-grade tumors might be missed, particularly if they are located in areas of the prostate that are less accessible to imaging.

CT scans and MRIs, while more sensitive than ultrasound, also have their limitations. For instance, while multiparametric MRI (mpMRI) is a significant advancement in prostate cancer diagnosis, offering better differentiation between cancerous and non-cancerous tissue, it is still not universally available and can be costly [9]. Additionally, mpMRI is not perfect; it may produce false positives or false negatives, leading to either unnecessary biopsies or missed cancers. Furthermore, the interpretation of mpMRI results requires specialized training and experience, which may not be readily available in all healthcare settings.

Biomarkers, such as the prostate-specific antigen (PSA), play a crucial role in the early detection of prostate cancer, but they too are not without their challenges. The PSA test, while widely used, has limitations in both sensitivity and specificity [6]. Elevated PSA levels can indicate the presence of prostate cancer, but they can also result from benign conditions such as BPH or prostatitis. This lack of specificity can lead to overdiagnosis, where men without clinically significant prostate cancer undergo unnecessary biopsies and treatments, exposing them to potential side effects without clear benefits. Conversely, some men with prostate cancer may have normal PSA levels, leading to missed diagnoses. These limitations highlight the need for more accurate and reliable biomarkers that can better differentiate between benign and malignant conditions and identify cancers at an earlier, more treatable stage.

The development and validation of new diagnostic tests and biomarkers are therefore critical for improving the early detection of urological diseases [6]. Advances in molecular biology and genomics are paving the way for the discovery of novel biomarkers that could offer greater accuracy in diagnosing urological cancers and other conditions. For example, liquid biopsies, which detect cancer-related genetic material in the blood or urine, hold promise as a less invasive and more accurate method of detecting urological cancers at an earlier stage. Similarly, the integration of machine learning and artificial intelligence (AI) into diagnostic processes has the potential to enhance the interpretation of complex imaging data and identify patterns that may not be evident to human clinicians alone.

However, these emerging technologies and biomarkers must undergo rigorous validation before they can be widely adopted in clinical practice. This process involves extensive clinical trials to ensure that new tests are not only accurate and reliable but also cost-effective and accessible. Moreover, the integration of these new tools into routine clinical practice will require updates to clinical guidelines and the training of healthcare professionals to ensure they can effectively utilize these advancements.

Emerging Complexities: The landscape of urological disease diagnosis is becoming increasingly complex due to a variety of emerging factors, including the growing prevalence of comorbidities and the significant impact of aging populations [10]. As global populations continue to age, the incidence of urological diseases such as prostate cancer, benign prostatic hyperplasia (BPH), bladder cancer, and kidney stones is rising. This demographic shift is driving an unprecedented demand for diagnostic services and straining healthcare systems that must adapt to meet the needs of an older and more medically complex population.

Aging is inherently associated with an increased risk of developing urological diseases [16]. For instance, prostate cancer is predominantly a disease of older men, with the majority of cases diagnosed in individuals over the age of 65. Similarly, BPH, which affects the prostate gland and causes urinary symptoms, becomes more prevalent as men age, affecting a significant proportion of men over 50. As life expectancy increases, so too does the number of people living with these conditions, creating a greater burden on healthcare systems to provide timely and accurate diagnoses.

The situation is further complicated by the presence of comorbid conditions, which are increasingly common among aging populations. Chronic diseases such as diabetes, hypertension, and cardiovascular disease are prevalent in older adults and often coexist with urological conditions. These comorbidities can obscure the clinical presentation of urological diseases, making diagnosis more difficult. For example, symptoms of lower urinary tract dysfunction can be exacerbated by diabetes or heart failure, leading to diagnostic challenges in determining the primary cause of a patient's symptoms. Additionally, the treatment of these comorbid conditions can impact the management of urological diseases [16]. Medications for hypertension or diabetes, for instance, may affect renal function or interact with treatments for urological conditions, requiring careful consideration

and coordination between healthcare providers. The management of patients with multiple comorbidities also demands a more nuanced approach to diagnosis. Clinicians must take into account the entire spectrum of a patient's health when evaluating urological symptoms, which can lead to more complex diagnostic processes and decision-making. This complexity often necessitates the involvement of multidisciplinary teams that include urologists, primary care physicians, endocrinologists, cardiologists, and other specialists. Coordinating care among these providers is essential but can be challenging, especially when there is a lack of communication or integration within the healthcare system.

In parallel with these demographic and clinical challenges, technological advancements are rapidly transforming the field of urology. The integration of artificial intelligence (AI) and machine learning into diagnostic processes is one of the most promising developments in recent years [18]. These technologies have the potential to significantly enhance the accuracy and efficiency of urological diagnoses by analyzing large datasets, identifying patterns, and predicting outcomes that may not be immediately apparent to human clinicians. For example, AI algorithms can be trained to interpret imaging data, such as multiparametric MRI scans of the prostate, with a level of precision that rivals or even surpasses that of experienced radiologists. By assisting in the early detection of prostate cancer or other urological diseases, AI could reduce the incidence of missed or delayed diagnoses and improve overall patient outcomes. However, the integration of AI and machine learning into clinical practice is not without its challenges [18]. One of the primary concerns is the need for robust validation of these technologies. AI models must be rigorously tested in diverse clinical settings to ensure that they perform reliably across different populations and healthcare environments. This validation process requires large-scale clinical trials and longitudinal studies that can confirm the effectiveness and safety of AI-driven diagnostic tools. Additionally, there is a need for transparency in how these algorithms are developed and trained, as biases in the data used to train AI models could lead to disparities in care or inaccurate diagnoses for certain patient groups.

Ethical considerations also play a critical role in the adoption of AI in urology. Issues such as patient consent, data privacy, and the potential for AI to replace human decision-making must be carefully navigated [18].

While AI can augment the diagnostic process, it is essential that human clinicians remain central to patient care, using AI as a tool to enhance their expertise rather than as a replacement for clinical judgment. The ethical deployment of AI requires clear guidelines and regulations to ensure that these technologies are used responsibly and to the benefit of all patients. Despite these challenges, early adopters of AI in urology have reported promising results. For instance, AI algorithms have been successfully used to predict the aggressiveness of prostate cancer based on biopsy samples and to identify patients at high risk for kidney stones based on electronic health record data. These applications demonstrate the potential of AI to revolutionize the early diagnosis of urological diseases, leading to more personalized and precise care. As these technologies continue to evolve, they are likely to become integral components of urological practice, helping to overcome some of the complexities introduced by aging populations and comorbid conditions.

Conclusion: The early diagnosis of urological diseases is essential for improving patient outcomes, yet numerous challenges hinder timely detection. These challenges include patient-related factors, healthcare system limitations, diagnostic uncertainties, and emerging complexities. Addressing these issues requires a multifaceted approach, including public education, healthcare system reform, advancements in diagnostic tools, and careful integration of new technologies. By overcoming these obstacles, the early diagnosis of urological diseases can be significantly improved, leading to better patient outcomes and more efficient healthcare delivery.

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