SELECTION OF IMAGING METHODS FOR VARIOUS PROSTATIC DISEASES

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Abstract

Diseases of the prostate gland represent one of the most pressing issues in modern urology. They are widely prevalent among the male population, particularly in the age group over 45, and are characterized by a high frequency of medical consultations. For effective diagnosis and treatment planning, it is essential to consider the specific imaging features of each type of prostate pathology. This article reviews current imaging techniques, including transrectal ultrasound (TRUS), multiparametric magnetic resonance imaging (mpMRI), computed tomography (CT), and bone scintigraphy, in order to determine their diagnostic value in various conditions such as benign prostatic hyperplasia (BPH), inflammatory diseases (prostatitis), and suspected prostate cancer (PCa). The capabilities, limitations, and algorithms for selecting appropriate imaging methods are discussed depending on the clinical presentation.

Introduction

Diseases of the prostate gland hold a key position among urological pathologies in men, significantly affecting the quality of life and requiring a multidisciplinary approach to treatment. The most frequent prostate conditions include benign prostatic hyperplasia (BPH), chronic and acute prostatitis, as well as prostate cancer (PCa), which ranks among the leading causes of cancer-related mortality in the male population.

Given the high prevalence of these conditions, one of the most important aspects of clinical practice is the selection of an appropriate imaging strategy. Such

a strategy not only helps to clarify the diagnosis but also to determine the stage of the pathological process, predict disease progression, and evaluate treatment efficacy. Radiological methods offer unique capabilities to assess the anatomy, morphology, and functional state of prostatic tissue.

However, each imaging modality has its own indications and limitations. Therefore, the choice of the most suitable diagnostic method requires consideration of multiple factors, including the presumed diagnosis, clinical symptoms, presence of comorbidities, and the availability of equipment.

The aim of this study is to provide an extended analysis of current imaging methods used for evaluating the prostate gland, to compare their diagnostic performance in various disease scenarios, and to outline a rational algorithm for diagnostic decision-making in clinical urology.

Materials and Methods

This study was conducted at a multidisciplinary diagnostic center and included the analysis of 112 clinical observations of patients diagnosed with various prostate gland conditions. All patients underwent comprehensive radiological evaluation in both outpatient and inpatient settings. The age of the patients ranged from 42 to 81 years, with a mean age of 61.4 ± 6.3 years.

Clinical indications for imaging included complaints such as urinary difficulties, perineal pain, frequent nocturnal urination (nocturia), decreased libido or erectile function, elevated prostate-specific antigen (PSA) levels, and suspected malignant processes. For all patients, a standardized diagnostic protocol was followed, which included medical history taking, physical examination, laboratory tests, and radiological imaging techniques.

The following imaging modalities were utilized in this study:

- **Transrectal ultrasound (TRUS)** with Doppler imaging;

- **Multiparametric magnetic resonance imaging (mpMRI)** using the PI-RADS v2.1 scoring system;
- **Computed tomography (CT)** of the pelvic organs with intravenous contrast;
- **Bone scintigraphy** in patients with suspected metastatic involvement.

To evaluate the effectiveness of each method, parameters such as sensitivity, specificity, and correspondence to the final clinical diagnosis were assessed. Data analysis was performed using the SPSS version 26.0 software package. Descriptive statistics, correlation analysis, and comparative assessment of diagnostic accuracy were employed.

Results

The results of the study demonstrated a varying degree of diagnostic value for each imaging method, depending on the type and stage of the disease. TRUS proved to be the most useful tool for the initial evaluation of patients with clinical signs of benign prostatic hyperplasia. In 93% of such cases, ultrasound revealed an enlarged prostate volume, hypoechoic nodules, and heterogeneous tissue structure — all characteristic signs of hyperplastic changes.

However, in cases of prostatitis, particularly chronic prostatitis, the ultrasound image was less specific and often required further diagnostic confirmation by additional methods. Inflammatory changes were sometimes subtle or diffusely distributed, reducing TRUS sensitivity.

Multiparametric MRI demonstrated high sensitivity in detecting malignant lesions, particularly in patients with suspected prostate cancer. This modality enabled precise visualization of suspicious foci, as well as assessment of tumor size, location, capsular involvement, and invasion of the seminal vesicles. In 89% of suspected cancer cases, the MRI findings were later confirmed by histological examination, highlighting the method’s high diagnostic accuracy.

CT was mainly used at the staging phase of malignant disease. It proved effective for assessing pelvic lymph node status and identifying potential metastatic lesions in adjacent organs. Bone scintigraphy was performed in 21 cases with confirmed prostate cancer and high suspicion of skeletal metastases. In 11 of those patients, multiple osteoblastic metastatic lesions were confirmed.

Table 1. Diagnostic value of imaging methods for prostate diseases

Method	**Benign Prostatic Hyperplasia (BPH)**	**Prostatitis**	**Prostate Cancer (PCa)**
TRUS	High (up to 90%)	Moderate	Limited (useful for zonal assessment)
MRI	Moderate	High (especially chronic cases)	Very high sensitivity and specificity (up to 94%)
CT	Low	Low	Effective for staging and metastases
Scintigraphy	Not indicated	Not indicated	Essential for bone metastasis detection

Discussion

The analysis of the data made it possible to identify the strengths and weaknesses of each imaging modality in the context of specific clinical goals. TRUS remains the most accessible and cost-effective method for evaluating benign prostatic hyperplasia and early inflammatory changes. Its widespread availability and minimal contraindications make it the method of choice at the primary stage of patient assessment.

However, when prostate cancer is suspected, particularly with tumors located in the anterior portion of the gland, the diagnostic value of TRUS decreases significantly. In these scenarios, TRUS often fails to detect the lesion, especially if it lacks distinctive echogenicity.

Multiparametric MRI, on the other hand, is a highly advanced diagnostic tool that enables comprehensive assessment of both the structural and functional characteristics of prostate tissue. The PI-RADS classification system helps standardize interpretation, improve reproducibility, and enhance clinical decision-making. mpMRI is particularly indicated in patients with elevated PSA levels and previous negative biopsy results, offering detailed localization and risk stratification of suspicious lesions.

CT is not considered suitable for initial diagnosis of localized prostate lesions due to its limited soft-tissue contrast. Nevertheless, it plays a critical role in advanced stages of disease when it is necessary to evaluate extra-prostatic extension and lymph node involvement. Bone scintigraphy remains the gold standard for identifying skeletal metastases, especially in high-risk patients with elevated PSA or bone pain. It provides valuable information for oncological staging and treatment planning.

Conclusion

The choice of radiological imaging methods for evaluating prostate diseases should always be personalized and guided by the patient's clinical profile, suspected pathology, physical findings, and laboratory data. TRUS maintains its role as the first-line tool for assessing benign hyperplasia and prostatitis due to its availability and low cost.

Multiparametric MRI has become the central imaging modality in oncologic urology, owing to its superior sensitivity and specificity. It is especially beneficial for tumor localization, staging, and guiding biopsy and treatment.

CT and scintigraphy are reserved for staging and detecting metastatic spread, particularly in cases of advanced or high-risk prostate cancer. An integrated and task-oriented diagnostic strategy ensures higher diagnostic accuracy, improves clinical decision-making, and contributes to more effective management of patients with prostate disorders.

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