

# Incidental Extraprostatic Findings in Multiparametric Prostate MRI: A Retrospective Evaluation from a Tertiary Care Center

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## Abstract

**Objective:** Prostate cancer is a significant health problem in men worldwide. Multiparametric magnetic resonance imaging of the prostate (mpMRI) is a diagnostic tool used in the management of men with suspected prostate cancer. This modality provides valuable information regarding extraprostatic tissues and the prostate gland. This study aimed to identify incidental extraprostatic findings (IEPFs) in patients who underwent mpMRI.

**Methods:** Data from patients who underwent mpMRI at our institution between October 2021 and September 2022 were retrospectively reviewed. Two experienced radiologists assessed the mpMRI scan images and reported using the Prostate Imaging Reporting and Data System (PI-RADS) categories. The findings were categorized as either related or unrelated to the genitourinary system. The findings were categorized into three groups: mild, moderate, and severe. A comparative analysis was performed to determine the clinical relationship between the PI-RADS score and age.

**Results:** A total of 1000 scans were reviewed. A total of 29.4 % (n=294) of the patients had IEPFs. Fifty-one (5.1%) of these findings were related to the genitourinary system of the patient. Categorization based on the severity of the findings revealed that 333 patients had mild, 20 had moderate, and 13 had severe IEPFs. Analysis revealed a statistically significant difference in the distribution of genitourinary and non-genitourinary findings across groups ( $p < 0.001$ ).

**Conclusion:** As a diagnostic adjunct tool, mpMRI is not only valuable for aiding in the diagnosis of prostate cancer but also for the detection of IEPFs, the distribution of these findings differs significantly between genitourinary and non-genitourinary system, which may have important clinical implications.

**Keywords:** extraprostatic findings, MRI, PI-RADS score, prostate

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## INTRODUCTION

Prostate cancer is the second most common cause of cancer-related deaths among men. Prostate-specific antigen (PSA) and digital rectal examination (DRE) are considered the initial steps in the diagnosis of prostate cancer (1). Multiparametric prostate magnetic resonance imaging (mpMRI) is performed before prostate biopsy (2).

mpMRI is more sensitive in detecting lesions defined as International Society of Urological Pathology (ISUP) grade 2 or higher (2). The current European Association of Urology (EAU) guidelines recommend performing mpMRI before biopsy, especially in patients with normal DRE findings and PSA values in the range of 2-10 ng/mL, who are suspected to have prostate cancer.

MpMRI can also effectively detect clinically significant prostate cancer and reveal extracapsular extension, lymph node metastasis, and metastases in the pelvic bones within the target area (2-5). Another advantage of mpMRI is that it can detect incidental findings unrelated to the genitourinary system. Although this is not uncommon, there are only a few studies on this subject (9,12,13).

This study aimed to present our data on incidental extraprostatic findings (IEPFs) in patients who underwent mpMRI and to increase awareness among clinicians interpreting mpMRI images.

## MATERIALS AND METHODS

### Study Design and Setting

This retrospective observational study included patients who underwent mpMRI at our institution between October 2021 and September 2022 following suspicion of prostate cancer based on elevated serum PSA levels and/or DRE. A retrospective analysis allows the assessment of incidental findings without altering patient care or imaging parameters. However, the design is inherently subject to certain limitations, including selection bias (e.g., patients referred to a tertiary center may differ from the general population) and observer bias (despite a dual-reader review). To minimize these biases, two radiologists with different experience levels independently reviewed the images and reached a consensus on all findings.

**Exclusion Criteria:** Patients with lymph node metastasis, seminal vesicle invasion, and bladder invasion, technically inadequate mpMRI scans (e.g., incomplete sequences or excessive motion artifacts), and missing or incomplete patient records.

**Imaging Protocol:** MpMRI scans were performed using a 1.5 Tesla system (Optima MR450, GE Healthcare). The scan consisted of T1-T2 weighted imaging, diffusion-weighted imaging (DWI), and dynamic contrast-enhanced sequences. Hyoscine-N-butylbromide (20 mg) was administered to reduce bowel motion. **Image Evaluation:** Two radiologists (8 and 3 years of experience) jointly reviewed the images. Findings consistent with direct prostate cancer involvement were excluded from the IEPFs classification. All other findings were categorized as genitourinary (GU) or non-genitourinary (non-GU) and graded as follows:

Group 1: Mild (clinically insignificant)

Group 2: Moderate (requires follow-up)

Group 3: Severe (urgent management)

### Statistical Analysis

Statistical analyses were performed using SPSS v25.0. Normality was assessed using the Shapiro-Wilk test. One-way ANOVA was used to compare age; Kruskal-Wallis test for Prostate Imaging Reporting and Data System (PI-RADS) score; Chi-square test for GU/Non-GU across groups. Descriptive statistics are presented as mean  $\pm$  SD or median (IQR) and frequencies with percentages. Confidence intervals (CIs) were calculated for the prevalence data.

**Power Analysis:** A post hoc power analysis was conducted using the observed proportions between Groups 1 (75.4%) and 2+3 (24.6%). The power to detect this difference with 294 patients exceeded 99% ( $\alpha = 0.05$ ), confirming the adequacy of the sample size.

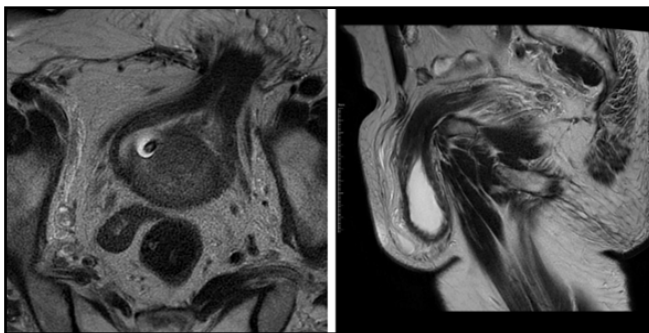
**Ethics and Confidentiality:** This study has been approved by the Institutional Ethical Review Committee of Istanbul Umraniye Training and Research Hospital (No:106).

Data were anonymized and managed according to institutional privacy policies to ensure confidentiality in compliance with the ethical standards for retrospective studies.

## RESULTS

During the study period, mpMRI was performed in 1058 cases. Among these patients, five could not undergo mpMRI because of claustrophobia, contrast allergy, and the presence of an MRI-incompatible cardiac pacemaker. Therefore, the target population consisted of 1053 patients who underwent mpMRI. However, 53 patients were excluded due to lymph node metastasis (n=45), seminal vesicle invasion (n=7), and urinary bladder invasion (n=1). Thus, 1000 patients were included in the study. A retrospective review of these scans revealed IEPFs in 294 cases (29.4 %). Multiple extraprostatic findings were detected in 74 patients. A total of 51 findings were related to the genitourinary system (Table 1).

Bladder diverticulum (n=9), diffuse bladder wall thickening compatible with cystitis (n=8), epididymal cysts (n=8), hydrocele (n=6), bladder stones (n=5), bladder trabeculation (n=4), herniation of the bladder into the inguinal canal (n=3), utricle cyst (n=1), seminal vesicle calcification (n=1), cystic dilation of the ureter (n=1), and undescended testicle (n=1) were detected as IEPFs (Figure 1). In four cases, irregular thickening of the bladder wall was observed, and in three of these cases, biopsy and subsequent histopathological evaluation revealed bladder cancer.

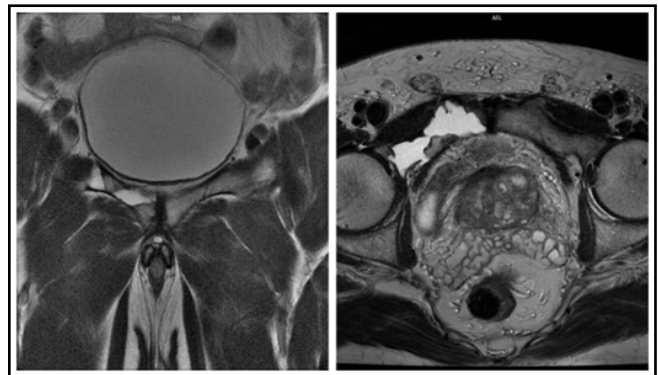


**Figure 1.** Axial and coronal T2-weighted MR images of bladder herniation into the inguinal canal

In a case with a PI-RADS score of 5, histopathological examination led to a diagnosis of urothelial carcinoma. On this mpMRI image, a diffusion-restricting lesion was identified at the distal end of the right ureter, accompanied by thickening of the bladder wall.

In our series, 315 IEPFs were unrelated to the genitourinary system (Table2, Figure 4). Inguinal hernia was detected in 187 cases. Of these patients, five had both bowel and fatty tissue

herniation, whereas 182 had only fatty tissue herniation. Other findings included T1-T2 hypointense sclerotic bone lesions initially considered as enostosis (n=85), free fluid in the pelvis (n=13), trochanteric bursitis (n=3), metastatic lesions in the pelvic bones (n=2), trauma-related fracture in the coccygeal bone (n=2), aneurysmal bone cyst in the pubic bone (n=1), lymphocele (n=1), lumbosacral transitional vertebral anomaly (n=12), Tarlov cyst (n=5), and avascular necrosis (n=1) (Figure 2). In one case with a PI-RADS score of 2, suspicious multiple obturator and pararectal lymphadenopathies were detected. Sampling of these adenopathies led to the diagnosis of chronic lymphocytic leukemia. In another case, rectum invasion was observed. In another case with a PI-RADS score of 2, the sonographic examination performed due to a centrally vascularized inguinal lymphadenopathy without a fatty hilum and with asymmetrical cortical thickening led to the diagnosis of tuberculosis (Figure 3).



**Figure 2.** Cystic lesion with thin septations in the right pubic ramus adjacent to the right symphysis pubis (aneurysmal bone cyst due to biopsy).

Based on the clinical significance of the IEPFs, 333 (91%) patients were classified as Group 1 ( mild), 20 (5.5%) patients were classified as Group 2 (moderate), and 13 (3.5%) as Group 3 (severe).

Table 2 presents the comparative demographic and imaging metrics across the groups. Group 1 had a slightly higher mean age ( $62.4 \pm 5.6$ ); however, this difference was not statistically significant ( $p = 0.9782$ ). GU findings were significantly more common in group 1. Chi-square analysis showed a significant difference in the distribution of genitourinary and non-genitourinary findings among the groups ( $p < 0.001$ ).

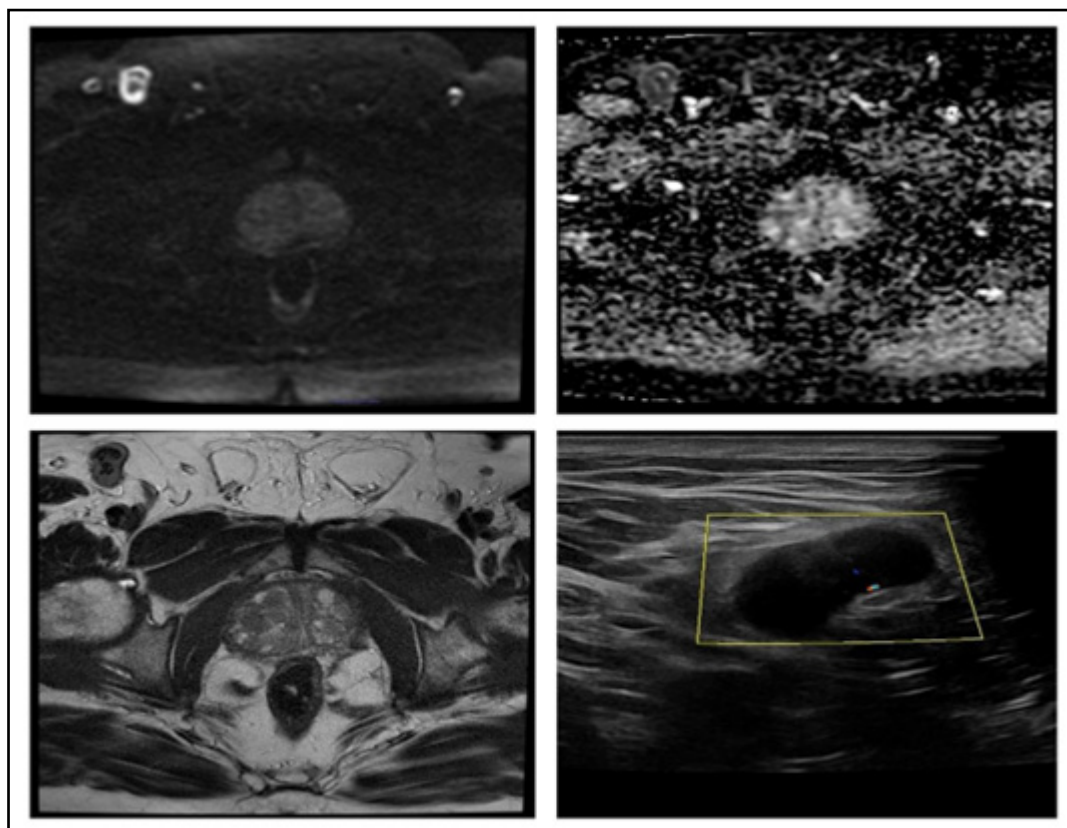
**Table 1.** Extraprostatic Findings by Clinical Significance Group (Sorted by Frequency)

| Extraprostatic findings                                 | Group 1 | Group 2 | Group 3 |
|---------------------------------------------------------|---------|---------|---------|
| Inguinal hernia                                         | 182     | 0       | 0       |
| Enostosis                                               | 85      | 0       | 0       |
| Pelvic free fluid                                       | 13      | 0       | 0       |
| Lumbosacral transitional anomaly                        | 12      | 0       | 0       |
| Bladder diverticulum                                    | 9       | 0       | 0       |
| Bladder wall thickening                                 | 0       | 8       | 0       |
| Epididymal Cyst                                         | 8       | 0       | 0       |
| Hydrocele                                               | 6       | 0       | 0       |
| Tarlov cyst                                             | 5       | 0       | 0       |
| Bowel hernia                                            | 0       | 5       | 0       |
| Bladder stone                                           | 0       | 5       | 0       |
| Bladder trabeculation                                   | 4       | 0       | 0       |
| Trochanteric bursitis                                   | 3       | 0       | 0       |
| Bladder carcinoma                                       | 0       | 0       | 3       |
| Bladder hernia                                          | 0       | 0       | 3       |
| Pelvic bone metastasis                                  | 0       | 0       | 2       |
| Coccyx fracture                                         | 2       | 0       | 0       |
| Tuberculosis                                            | 0       | 0       | 1       |
| Rectal invasion                                         | 0       | 0       | 1       |
| Undescended testicle                                    | 0       | 1       | 0       |
| Transitional cell carcinoma of the genitourinary system | 0       | 0       | 1       |
| Aneurysmal bone cyst                                    | 0       | 0       | 1       |
| Prostatic utricle cyst                                  | 1       | 0       | 0       |
| Lymphocele                                              | 1       | 0       | 0       |
| Cystic dilatation of the ureter                         | 1       | 0       | 0       |
| Chronic lymphocytic leukemia                            | 0       | 0       | 1       |
| Calcification of the seminal vesicle                    | 1       | 0       | 0       |
| Femoral head avascular necrosis                         | 0       | 1       | 0       |

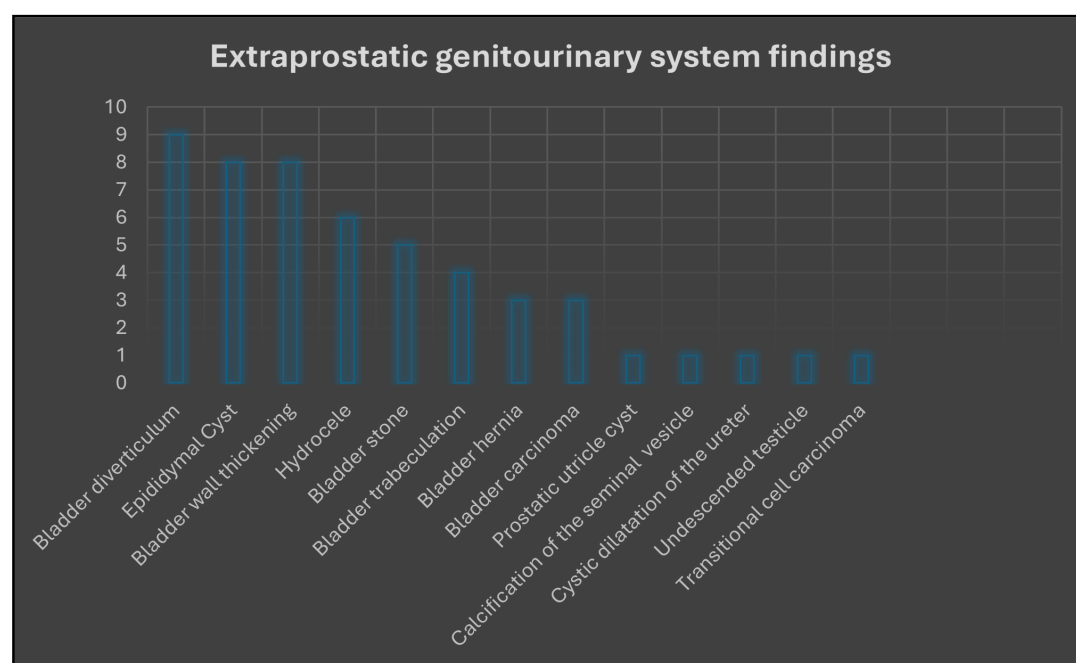
**Table 2.** Variable Comparison Across Clinical Significance Groups

| Variable                   | Group 1        | Group 2        | Group 3        | p               |
|----------------------------|----------------|----------------|----------------|-----------------|
| Mean Age $\pm$ SD          | 62.4 $\pm$ 5.6 | 62.5 $\pm$ 6.0 | 62.1 $\pm$ 6.2 | 0.9782 $\gamma$ |
| Median PI-RADS category    | 2.0            | 2.0            | 2.0            | -               |
| Genitourinary Findings     | 30             | 14             | 7              | <0.001 $\chi^2$ |
| Non-genitourinary Findings | 303            | 6              | 6              |                 |

Statistical tests used:  $\gamma$ = One-way ANOVA was used for age,  $\circ$ = Kruskal-Wallis test was used for PI-RADS,  $\chi^2$ = Chi-square test was used to compare genitourinary vs. non-genitourinary distribution across groups.



**Figure 3.** Multiparametric Prostate MR examination and ultrasound images of tuberculosis-associated inguinal lymphadenopathy



**Figure 4.** Incidentally detected extraprostatic genitourinary system findings

## DISCUSSION

The use of mpMRI before biopsy in patients with suspected prostate cancer is recommended by current guidelines. Therefore, mpMRI has become an essential milestone in prostate biopsy decisions. It is more sensitive in patients with tumors larger than 6 mm and those with a high Gleason score (2,6-8).

Considering the high imaging quality provided by this method, mpMRI not only assists in decision-making regarding prostate biopsy but can also reveal IEPFs, which can lead to the diagnosis and treatment of these findings. In addition to IEPFs, MRI can also detect the invasion of prostate tumors into adjacent organs and lymphadenopathies (2).

Our study included 1000 patients, and IEPFs were detected in 294 (29.4%) of them. Of these, 51 (14%) were related to the genitourinary system, whereas 312 (86%) were unrelated. In a study conducted by Cutaia et al., which included 647 patients, IEPFs were detected in 52.7% of the cohort (9). In another study by Emekli et al. (10), 426 patients were included, and 49.8% had IEPFs. Similarly, Sherrer et al. (11) worked on the same subject and found that 40% of their 580 participants had IEPFs.

The lower percentage of patients with incidental findings in our study can be ascribed to the fact that our institution is a tertiary referral center and some potential IEPFs might have been treated before undergoing mpMRI at our institution. Additional factors, such as patient demographics, referral patterns, and imaging protocol variations, may also influence the observed rate. These factors should be considered when interpreting the lower detection rate.

Cutaia et al. showed that 322 (69.8%) patients with IEPFs had findings unrelated to the genitourinary system, while 139 (30.2%) had genitourinary system findings (9). In the study by Emekli et al., genitourinary system findings constituted 41.1% (n=132) of all IEPFs detected (10). In a study by Sherrer et al., 51% (n=179) of the 349 IEPFs were unrelated to the genitourinary system, while the remaining were genitourinary system-related (9-11). Our study aligns with the literature, as genitourinary system-unrelated findings were more common than genitourinary system findings.

In line with our analysis, Cutaia et al. categorized IEPFs according to their clinical significance (9). In this study, 355 patients were included in group 1, 94 patients were classified as group 2, and 12 (2.6%) patients were classified as group 3. In contrast, Emekli et al. classified patients into clinically significant and clinically insignificant IEPFs groups (10). The authors reported that 6.9% (n=22) of patients had clinically significant findings.

Since T2 coronal imaging focuses on the prostate in mpMRI performed in accordance with the PI-RADS score, liver and spleen lesions were not detected in our study. Fat-suppressed coronal T2-weighted images can be acquired to detect other organ pathologies. However, these approaches are time-consuming and expensive. Notably, artificial intelligence is a hot topic in mpMRI practice; however, its sensitivity in detecting IEPFs needs to be clarified (12).

In a study by Ediz et al. (13), the PI-RADS scoring system did not contribute to the diagnosis of incidental mp-MRI. This finding aligns with our results, as shown in **Table 2**, where no relationship was found between the PIRAD scores and IEPFs.

The recent review by Ponsiglione et al. (14) reported a substantially higher overall prevalence of incidental non-prostatic findings on mpMRI in different studies, compared to 29, 4 % in our cohort. This discrepancy may be attributed to differences in institutional imaging protocols, classification criteria, and patient selection criteria. Unlike their pictorial review, which broadly illustrated hepatic, renal, and gastrointestinal findings, our study applied a structured three-tier classification (mild, moderate, severe) and specifically quantified genitourinary IEPFs. Genitourinary lesions were emphasized in our dataset, comprising 13.9% of all incidental findings. Additionally, our exclusion of patients with known metastatic or locally advanced disease may explain the relatively lower detection rate for some non-prostatic findings compared with the broader inclusion criteria in their analysis.

Our study had some strengths and limitations. The main limitations of this study are its retrospective design, single-center data, and relatively limited number of patients

included. However, our study is the most extensive series to date, which represents its strength.

## CONCLUSION

Despite the abovementioned limitations, we conclude that mpMRI plays a vital role in detecting prostate cancer and identifying incidental extraprostatic findings, which can be clinically significant and life-saving in some cases. A standardized approach to interpret and classify IEPFs may enhance clinical decision-making.

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**Conflicts of interest:** The authors declare that they have no competing interests.

**Ethics Statement:** This study has been approved by the Institutional Ethical Review Committee of Istanbul Umraniye Training and Research Hospital (No:106).

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