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Multiparametric MR Evaluation of an Unusual Case of Periprostatic Leiomyoma with Bizarre Nuclei

Case Report

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Abstract

A middle-aged patient with perineal pain and frequent urination had a periprostatic mass detected via Transrectal Ultrasound (TRUS). The serum prostatic surface antigen (PSA) level was within normal range. Multiparametric MRI (mp-MRI) revealed a mildly enlarged prostate. No abnormal focal or diffuse T2W hypointense lesions were detected in the prostate. A well-defined periprostatic mass measuring 27 x 18.4 x 22.9 mm, exhibiting T1W/T2W hypointense signals, was identified. The mass closely abutted prostatic apex, anteroinferior capsule, anterior rectal wall, and left puborectalis sling, without invasion or infiltration. DWI indicated no diffusion restriction. The dynamic contrast-enhanced MRI (DCE-MRI) showed slow continuous enhancement within the mass, potentially excluding malignancy. Additionally, absence of T2W hypointense lesions in transition-zone ruled out stromal nodules of BPH. Furthermore, absence of such lesions in the transition/ and or peripheral-zone, along with an intact prostatic-capsule, excluded prostatic malignancy with extracapsular extension. The absence of T2W hyperintense lesions in peripheral-zone of prostate excluded STUMP. The lack of irregular margins, invasion, or infiltration into surrounding structures, along with absence of diffusion restriction in DWI, and the lack of early hyperintensity in DCE-MRI collectively rules out the likelihood of various malignant mesenchymal tumors. TRUS-guided biopsy for histopathological examination (HPE) supported by immunohistochemistry (IHC), conclusively identified the mass as a periprostatic Leiomyoma with Bizarre Nuclei (LBN). LBN is extremely rare and carries a potential for malignant transformation. In conclusion, mp-MRI stands as a valuable modality for characterizing a periprostatic mass, facilitating differentiation between benign and malignant lesions. However, a definitive diagnosis requires HPE and IHC.

Keywords: Multiparametric MRI; Prostatic Mesenchymal Tumors; Periprostatic Mass; Leiomyoma with Bizarre Nuclei

Introduction

The presence of a periprostatic mass presents a diagnostic challenge, as it can closely resemble primary prostatic diseases, especially malignancies [1-3]. About 60-70% of prostatic malignancies manifest as hypoechoic focal lesions in Transrectal Ultrasound (TRUS) relative to normal peripheral zone, while 30-40% are isoechoic and may thus go unnoticed[4].Multiparametric MRI (mp-MRI) is currently the leading imaging modality for detecting and characterizing various prostatic lesions due to its exceptional sensitivity and specificity [5,6,7]. While certain peri-prostatic masses exhibit characteristic imaging features, histopathological evaluation (HPE) is essential for a precise diagnosis [2,8,9].

Case Report

We report an unusual case of periprostatic mass in a patient aged

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47-years with perineal pain and frequent urination for the past three months. There was no history of fever, urinary retention, hematuria, or ejaculatory impairment. Digital rectal examination revealed a palpable firm to hard nodular mass anterior to the rectum. Serum prostate-specific antigen (PSA) level was 0.9 ng/ml [normal <4.00 ng/ml]. The patient exhibited normal renal and liver functions, as evidenced by laboratory results, and urinalysis was unremarkable.

The TRUS indicated prostate volume of approximately 33 cc and revealed a hypoechoic mass measuring 2.5 cm x 2.3 cm that extended beyond the prostate. There was no discernible distortion of the prostatic capsule. In the mp-MRI using 1.5 T scanner, a mildly enlarged prostate was identified with a volume of 32 cc. No abnormal focal or diffuse T2W hypointense lesions were detected in the transition and / or peripheral zone. Prostate margins were delineated as a thin rim of low signal intensity, indicating intact prostatic capsule. Remarkably a well-defined periprostatic mass, measuring 27 x 18.4 x 22.9 mm, was delineated. The mass closely abutted the anteroinferior capsule and displayed hypointense signals in both T1W and T2W sequences (Figure1A) (Figure 1B). Its proximity to the apex of the prostate was observed without any infiltration into parenchyma. Additionally, the mass was noted to abut the anterior rectal wall and the left puborectalis sling (Figure2A), (Figure 2B). The seminal vesicles, urinary bladder, rectum, and neurovascular bundle exhibited no invasion or infiltration. There was an absence of ascites or pelvic lymphadenopathy. DWI and ADC mapping revealed no diffusion restriction (Figure3A), (Figure 3B). The DCE-MRI demonstrated a slow, continuous, homogenous contrast enhancement within the mass (Figure 4A), (Figure 4B).

TRUS guided biopsy for HPE of the mass showed an encapsulated tumor of spindle cells arranged in fascicles with elongated blunt nuclei, mild nuclear atypia, minimal mitosis (1/10 HPF), absence of necrosis, invasion, or glandular element (Figure 5A), (Figure 5B) Immunohistochemistry (IHC) revealed positive expressions for desmin(Figure 6A) smooth muscle actin (SMA) (Figure. 6B) and a low Ki-67 nuclear protein (Figure 6C). On the contrary, the staining was negative for cluster of differentiation 34 and C-kit. The results of HPE and IHC staining collectively confirmed the diagnosis of a periprostatic Leiomyoma with Bizarre Nuclei (LBN).

Discussion

In the present case, the mp-MRI detected a slightly enlarged prostate with normal T1W and T2W signals. Prostate margins were well delineated as a thin rim of low signal intensity, indicating intact prostatic capsule. Remarkably, a well-defined periprostatic mass was discovered adjacent to the prostate apex, exhibiting hypointense signals in both T1W and T2W sequences. Significantly, no signs of invasion or infiltration into the prostatic parenchyma, seminal vesicle, neurovascular bundle, urinary bladder, rectum, or any other pelvic structure were observed.

The absence of T2W hypointense lesions in the transition zone of prostate ruled out possibility of stromal nodules of benign prostatic hyperplasia in the present case.

It is noteworthy that about 70% of prostatic malignancies occur within peripheral zone and manifest as a reasonably well defined T2W hypointensity, along with low ADC signals in the DWI, typically demonstrating early hyperintensity on DCE-MRI [6,7]. Therefore, the absence T2W hypointense lesions in the transition/ and or peripheral zones, along with an intact capsule, and normal PSA level, perhaps excludes prostatic malignancy with extracapsular extension in the present case [1,2,10].

In the current case, the DWI of the periprostatic mass revealed no diffusion restriction, with normal ADC values. DCE-MRI demonstrated a slow continuous wash-in, a feature linked with benign masses. This contrasts with the fast wash-in, leading to early hyperintensity, followed by fast wash-out with a reduction in enhancement, which is a hallmark of malignant masses [1].

The potential identification of this mass as a stromal tumor of uncertain malignant potential (STUMP) was contemplated. STUMPs typically manifest in the peripheral zone of the prostate at the base, presenting as a well-defined mass with a combination of solid and cystic components, exhibiting a distinctive high T2W signal intensity. DWI with ADC mapping often reveals moderately restricted diffusion, the degree of which depends on the proportion of cystic and solid components [2,3,8]. Nevertheless, in the present case, the mass was located adjacent to the prostatic apex and exhibited hypointense signals on T2W imaging, indicating absence of cystic component.

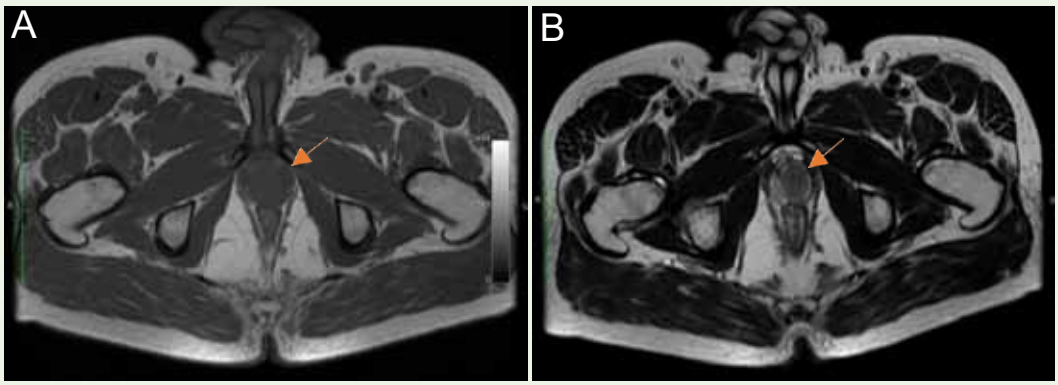

Figure 1: Axial T1W and (A) Axial T2W, B) images show hypointense mass (arrow).

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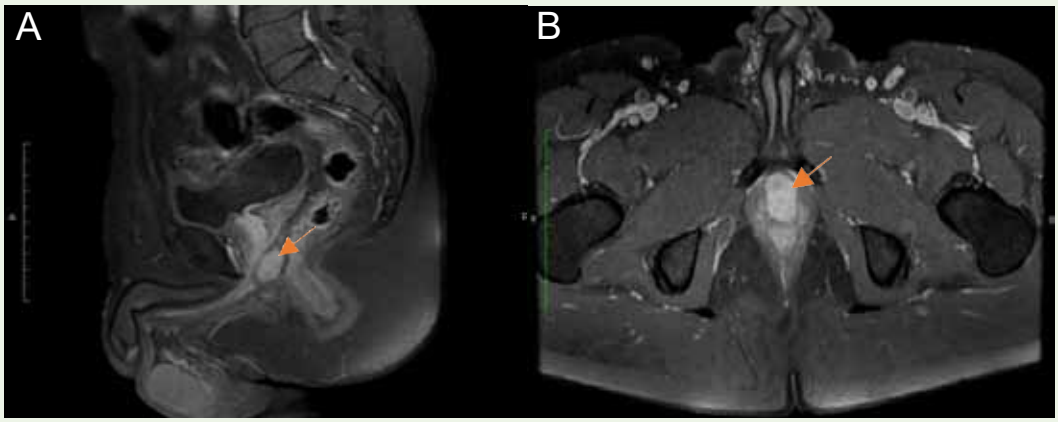

Figure 2: (A)T1W Sagittal and (B) T1W Axial contrast images show periprostatic mass (arrow) abutting the apex of prostate without invasion of parenchyma and abutting the anterior rectal wall.

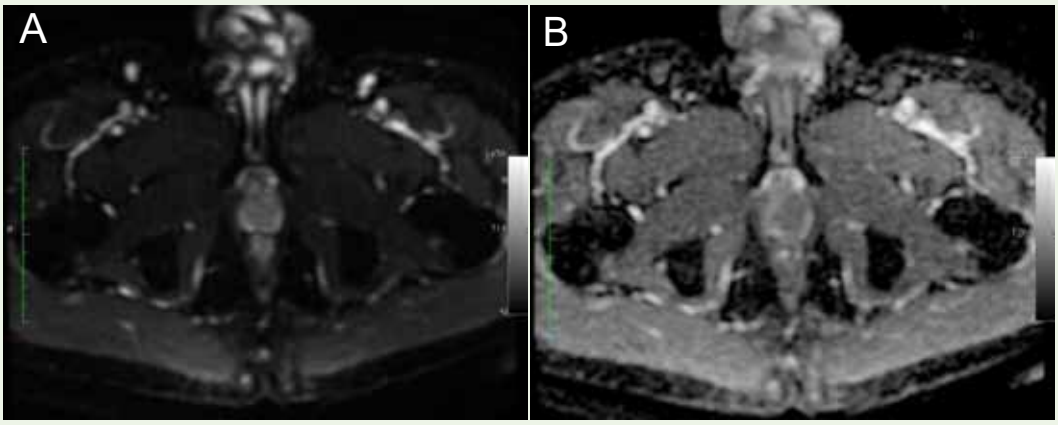

Figure 3: (A) Diffusion Weighted Imaging and (B) ApparentDiffusionCoefficient Map shows nodiffusion restriction in the mass.

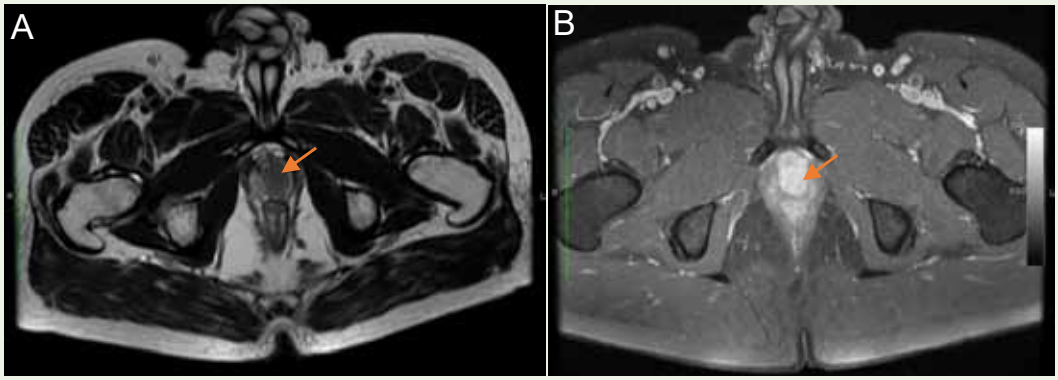

Figure 4: Dynamic contrast enhanced MRI: Axial T1W images show (A) Hypointense mass before administration of the contrast (arrow) (B) Post-contrast homogenous enhancement in the mass (arrow)

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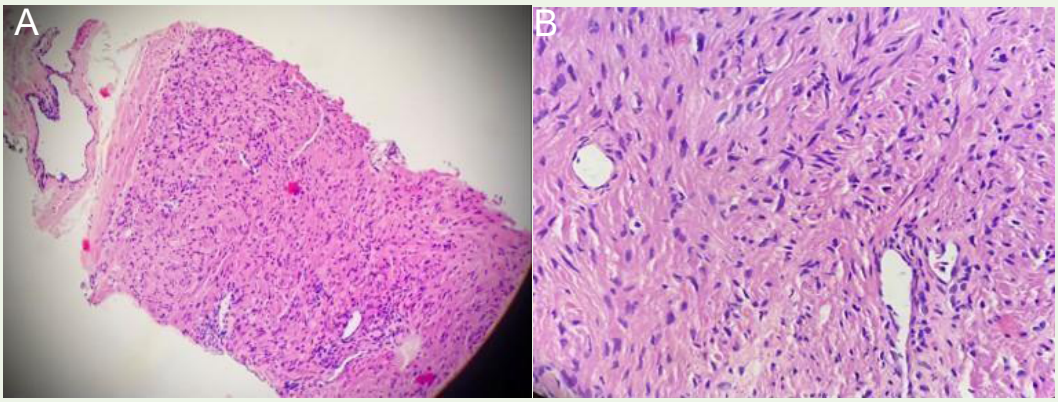

Figure 5: TRUS Biopsy from periprostatic mass shows (A) An encapsulated tumor having spindle cells arranged in fascicles, whorls & intersecting thin walled ectatic vessels. (B) Tumor cells have elongated blunt nuclei with mild nuclear atypia, eosinophilic bipolar cytoplasm, with minimal mitosis (1/10 HPF). No necrosis, invasion, or glandular elements.

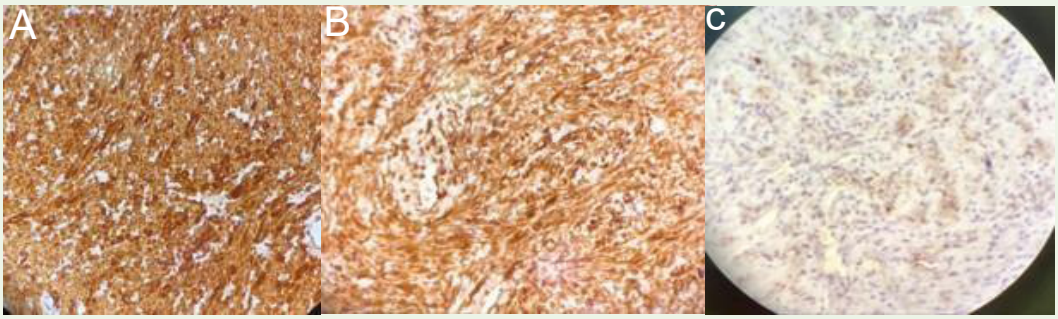

Figure 6: Immunohistochemistry expressed strongly to (A) Desmin, (B) SMA, with (C) low Ki-67.

Prostatic stromal sarcomas are primarily solid tumors. They were also considered in the differential diagnosis. They typically manifest as large masses invading adjacent structures. On MRI, they appear as hypointense regions on T1W images and exhibit heterogeneous hyperintensity on T2W images, indicative of underlying areas of internal necrosis, hemorrhage, and cystic degeneration. DWI and ADC mapping reveal varying degrees of restricted diffusion, based on the cellular composition of the mass [2,3,8]. However, absence of irregular margins of the mass, lack of invasion or infiltration into surrounding structures, and hypointense signals on T2W imaging in the current case, argues against the likelihood of prostatic stromal sarcoma.

The evaluation also considered malignant non-stromal mesenchymal tumors of prostate, including leiomyosarcoma, rhabdomyosarcoma, synovial sarcoma, and gastrointestinal stromal tumors (GIST). These tumors are rare and pose a diagnostic challenge. On MRI, they typically appear as hypointense regions on T1W images but display heterogeneous hyperintensity on T2W images, indicating underlying hemorrhage, internal necrosis, and local infiltration [2,3,8]. However, absence of irregular margins of the mass, lack of invasion or infiltration into surrounding structures, and the T2W hypointense signals, collectively diminish their possibility in the present case.

Prostatic solitary fibrous tumors (SFT) originate from periprostatic soft tissue, initially presenting as a predominantly fibrous benign mass with potential for malignancy. They were also considered in the differential diagnosis. On MRI, SFT typically appears hypointense on T1W images and exhibits heterogenicity on T2W images [2,3,8], showing a distinctive "chocolate chip cookie" appearance. This results from low-intensity foci in T2-weighted images, attributed to collagen content and low cellularity. As vascular tumors, SFT show robust enhancement [11]. However, in the present case, dynamic contrast enhanced study did not reveal pronounced enhancement within the mass.

GIST manifesting as a periprostatic mass typically arises at the anorectal junction or in the perirectal or periprostatic soft tissue potentially compressing and invading the prostate. On MRI, they typically appear as a well-defined lobulated mass with heterogenous T2 hyperintense signals, intermediate to low T1 signal intensity, and irregular enhancement. DWI and ADC mapping usually show marked diffusion restriction [2,3]. In the present case, the periprostatic mass

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marked by its non-invasiveness, hypointense T2-weighted signals, slow homogeneous enhancement pattern, with a normal anorectal junction diminishes the likelihood of it being a gastrointestinal stromal tumor.

Prostatic leiomyomas are uncommon. They typically arise from the central prostate towards the apex. They originate from the smooth muscle elements within the prostate's stroma, capsule, or mullerian remnants [2]. In the present case, distinctive mp-MRI characteristics including well-defined margins, proximity to the prostatic apex, the absence of infiltration or invasion into surrounding structures, typical low signal intensity on T2W images, and the absence of early enhancement in dynamic contrast-enhanced MRI, collectively point towards a benign tumor, likely a leiomyoma [2,3,8,12].

TRUS guided biopsy of the mass for histopathological examination revealed an encapsulated tumor comprising spindle cells arranged in fascicles with elongated blunt nuclei, mild nuclear atypia, a low mitotic rate (1/10 high-power fields [HPF]), and an absence of internal necrosis, invasion, or glandular elements consistent with the diagnosis of Leiomyoma with Bizarre Nuclei (LBN), previously termed symplastic leiomyoma [13,14]. Immunohistochemically, it differed from STUMP and GIST by its smooth muscle actin (SMA) (+), desmin (+), CD34 (-), and C-kit (-) staining pattern [2,8,9].

LBN represents a subgroup of leiomyomas, a category infrequently reported and primarily documented in uterine leiomyomata [14]. The World Health Organization has characterized LBN as a leiomyoma demonstrating focal or diffuse nuclear atypia, with or without increased mitosis typically averaging 1–2 mitoses/10 HPF, occasionally reaching up to 7–8 mitoses/10 HPFs, but not exceeding 10 mitoses/HPF [14]. Distinguishing LBN from leiomyosarcomas is crucial; the latter exhibits marked cellular atypia, ≥10 mitoses/10 HPF, hyperchromatic nuclei with moderate to severe nuclear pleomorphism, and tumor cell necrosis [14]. However, LBN may represent a precancerous stage of leiomyosarcoma, given the subsequent risk of malignant transformation [15,16,17]. Hence, some experts recommend radical surgery [15] while others advocate conservative management and close follow-up [16].

To conclude, mp-MRI stands as a valuable modality for identifying, localizing, and characterizing periprostatic masses, facilitating the differentiation between benign and malignant lesions. However, for a conclusive diagnosis, histopathologic examination (HPE) and immunohistochemistry (IHC) remain indispensable.

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