Research article

Multiparametric MR imaging in diagnosis of chronic prostatitis and its differentiation from prostate cancer

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Abstract

Chronic prostatitis is a heterogeneous condition with high prevalence rate. Chronic prostatitis has overlap in clinical presentation with other prostate disorders and is one of the causes of high serum prostate specific antigen (PSA) level. Chronic prostatitis, unlike acute prostatitis, is difficult to diagnose reliably and accurately on the clinical grounds alone. Not only this, it is also challenging to differentiate chronic prostatitis from prostate cancer with imaging modalities like TRUS and conventional MR Imaging, as the findings can mimic those of prostate cancer. Even biopsy doesn't play promising role in the diagnosis of chronic prostatitis as it has limited sensitivity and specificity. As a result of this, chronic prostatitis may be misdiagnosed as a malignant condition and end up in aggressive surgical management resulting in increased morbidity. This warrants the need of reliable diagnostic tool which has ability not only to diagnose it reliably but also to differentiate it from the prostate cancer. Recently, it is suggested that multiparametric MR Imaging of the prostate could improve the diagnostic accuracy of the prostate cancer. This review is based on the critically published literature and aims to provide an overview of multiparamateric MRI techniques in the diagnosis of chronic prostatitis and its differentiation from prostate cancer.

1. Introduction

Prostatitis is one of the common reasons why patients visit physicians and urologists. The prevalence of prostatitis is high, overall rate of 8.2%, which is comparable to rates of ischemic heart disease and diabetes [1]. This necessitates the need for accurate and reliable diagnostic tool. However, there are no specific physical findings or diagnostic laboratory tests to diagnose it. The National Institute of Health (NIH) established an International Prostatitis Collaborative Network (IPCN) and came with 4 categories of prostatitis syndromes viz. I) Acute bacterial prostatitis, II) Chronic bacterial prostatitis, III) Chronic non-bacterial prostatitis/Chronic pelvic pain syndrome (CP/CPPS) which was further categorized into inflammatory (category IIIA) and non-inflammatory (category IIIB), IV) Asymptomatic inflammatory prostatitis [1]. Acute and chronic bacterial prostatitis are best understood among them and are easier to diagnose clinically. Chronic nonbacterial prostatitis is the most common and affect 10–15% of male population [2], however, remains the diagnosis of exclusion. The working diagnostic criteria that is used clinically is the presence of pelvic pain or urinary symptoms for more than three of the previous 6 months with no evidence of

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acute bacterial prostatitis or urinary tract infection in that time [2]. Chronic prostatitis can be a cause of elevated prostate specific antigen (PSA) level. This warrants further investigations as the elevated PSA level should not be attributed to chronic prostatitis without ruling out prostate cancer [3,4]. The current emphasis is on the studies that provide indirect information about the prostate like DRE, Retrograde urethrography, Cystourethroscopy [5]. The reliable and accurate diagnosis has yet been difficult to achieve due to the heterogeneous nature of chronic prostatitis. MRI provides visualization of the interior structure and better delineation of anatomy and prostate pathologic condition. TRUS, CT and conventional MRI are informative but it is difficult to detect and differentiate chronic prostatitis from prostate cancer with these radiological modalities as the findings can mimic those of prostate cancer [6−8]. Multiparametric MRI is better at detecting the prostate cancer with high sensitivity and specificity [9,10]. Multiparametric MRI is also helpful in predicting the presence of prostate cancer in prostate biopsy [11]. It is also helpful in differentiating of prostatitis and prostate cancer [12].

2. Anatomy relevant to chronic prostatitis

MRI is superior to CT, ultrasound or other radiological modalities in delineating the anatomy of prostate and its surroundings. Prostate is a walnut shaped gland, which sits on the urogenital diaphragm in the lower pelvis just inferior to the urinary bladder (Figs. 1 and 2). The anterior wall is separated from the pubic bone by the retropubic fatty space of Retzius. The posterior wall is separated from the rectal ampulla by Denonvillier's fascia. The fluid filled seminal vesicles are situated postero-superior lying between the bladder and the rectum (Fig. 2B). The ejaculatory duct, which is formed after the seminal duct joins the ductus deference, enters the prostate gland posteriorly, runs into it and finally opens on the seminal colliculus (verumontanum) at the utricle of the prostatic urethra. Neurovascular bundles, responsible for erection of the penis, run from superior to inferior in the posterolateral sides of the prostate glands. The prostate gland is divided into base, mid-prostate and apex from superior to inferior (Fig. 2B).

The prostate is divided anatomically into three zones viz. the peripheral, the transition and the central zones (Figs. 1 and 2). Anterior fibromuscular stroma, mainly consisting of muscular and the connective tissue and lacking glandular tissue, is located in the anterior part of the prostate gland. The peripheral zone of the prostate is situated postero-inferiorly and is the most common location for malignancy, around 70−80% of the prostate cancer foci being located in this zone [13,14]. Located interiorly and surrounding the prostatic urethra is the transition zone and postero-superior to it is the central zone. Transition zone is common site for benign prostatic hyperplasia (BPH). The transition and the central zones are together called as internal or central gland, as they are barely distinguishable from one another [15]. Due to the occurrence of benign prostatic hyperplasia with increasing age, the morphology of central gland changes from central zone into transition zone. As nodules in the transition zone advances, the central zone undergoes compression with progressive displacement towards the prostatic base which makes anatomy of the central zone difficult to be defined with confidence by MR Imaging [16] (Fig. 1). Around 20% and 10% of the prostate cancer foci arise from the transition and the central zone, respectively [17]. Chronic prostatitis mainlyoccursin the peripheral zone of prostate and is more demonstrable than acute condition in the context of MRI examination. Chronic prostatitis can be present with symptoms of benign prostatic hyperplasia (BPH). It is also commonly associated with elevated serum prostate specific antigen (PSA). Therefore, it is an important differential in the diagnosis of prostate cancer.

3. MR examinations

Multiparametric prostate MR examination combines both conventional as well as functional MR imaging, and requires at least16 channel1.5 T with endorectal coil or 3.0 T with or without endorectal coil. 3.0 T image acquisition provides better signal-to-noise ratio (SNR) with faster acquisition of high quality image, with or without the use of endorectal coil [18]. However, the longer T1 and shorter T2 relaxation times are the disadvantages with higher field strength of 3.0 T [19].

3.1. T2 weighted MR imaging

T2WI MR Images are used to show anatomy of the prostate and its surrounding structures. The normal appearance of the peripheral zone of the prostate gland is characterized by the homogenous intermediate to high intensity signal (Fig. 3A). The peripheral zone is surrounded by capsule represented as a thin hypointense rim on MR image, which clearly depicts it from the transition and central zone. Lesions of chronic prostatitis, on T2WI MR imaging, usually present with unilateral or bilateral diffuse or flaky areas with little to no mass effect or wedge shaped areas of low signal intensity in the

Fig. 1. Axial T2WI showing the zonal anatomy of the prostate. The central gland (C) is shown as heterogeneous signal intensity surrounded by a crescent shaped hyperintense peripheral zone (P) on both sides.