

Original research article

An analysis comparing the diagnostic accuracy of elastography plus MRI image-based TRUS biopsy versus extended core biopsy for prostate cancer identification

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Abstract

Aim: The comparison of diagnostic accuracy for prostate cancer detection between elastography plus MRI image based TRUS biopsy versus extended core biopsy.

Methods: This Comparative study was carried out in the Department of Radio Diagnosis, Katihar Medical College, Katihar (Al-Karim University), Bihar, India for 1 year. 50 Patients with age group of 35 to 75 years, with Serum PSA greater than 4.0 ng/dl were included in this study. All patient underwent TRUS biopsy based on the MRI and elastography images, followed by TRUS guided extended core biopsy (13 cores) done by radiologist randomly. The rate of prostate cancer detection was compared between the two types of biopsies. Group A consisted of cores from MRI plus Elastography guided TRUS biopsy and Group B were cores from Extended core biopsy. Both group were compared.

Results: The mean age of patients was 63.71. The mean serum PSA for patients was 14.77 ng/dl (6.5 to 40.7). 20 cases presented with AUR and patients were catheterized. The mean size of prostate in all 50 patients was 51.77 mg (29 to 84 mg). The mean size of prostate and serum PSA of patients with carcinoma prostate were 14.9 mg and 18 ng/dl respectively . Prostatic carcinoma detection with extended core biopsy was 42% (n=21). The incidence of prostate cancer detection by MRI plus Elastography guided TRUS is 41 cases (82%). MRI plus Elastography guided TRUS biopsy method is considered to be statistically significant as the p value is 0.0369 (since $p < 0.05$) as obtained by fishers exact test. In our study majority of the patients had adenomatous hyperplasia (n=30,60%) as the HPE diagnosis , followed by adenocarcinoma (n=20,40%). The sensitivity of mpMRI plus Elastography image based TRUS biopsy method in detecting Prostate cancer was 84.5% and specificity was 82 % . The positive predictive value of this method was found to be 80%.

Conclusion: Although mpMRI and Elastography are individually useful for detection of prostate malignancy, combining both the diagnostic tools for TRUS guided increases the rate of cancer detection than that of extended core biopsy.

Keywords: mpMRI and elastography, prostate, biopsy

Introduction

Prostate cancer (PCa) is the second most common cause of cancer death in Australian men and is the most commonly diagnosed internal malignancy with one in seven Australian men being diagnosed with PCa by the age of 75.¹ PCa may first present with elevated prostate-specific antigen (PSA) on screening or symptomatically with lower urinary tract symptoms, bony pain from metastases or uncommonly with hematuria, urinary retention, or renal failure.² The definitive diagnosis of PCa is generally made by a biopsy, typically transrectal ultrasound

(TRUS)-guided biopsy. Staging is typically by a nuclear medicine bone scan or computed tomography positron emission tomography.³ An influential work by McNeal et al in 1988⁴ demonstrated trends in the zonal origin of PCa, particularly the predominance of malignancy within the peripheral zone (PZ) and hence its amenability to detection on digital rectal examination (DRE) and TRUS guided biopsy. However, a minority of cancers arose from more anterior regions of the prostate leading to a newly articulated phenomenon “prostatic evasive anterior tumor syndrome (PEATS).” PEATS describes a subset of PCa which, due to anatomical location, may be missed by traditional investigations such as DRE and TRUS biopsy, both of which primarily focus on the PZ, but may be detected by multiparametric magnetic resonance imaging (mpMRI) or transperineal biopsy (TPB).⁵ Management of PCa depends on risk stratification, most commonly the Gleason score, TNM staging, and PSA level. Lower risk cancers may be indolent and require active surveillance (AS) involving (with local variation) monitoring PSA levels (serial PSA tests), DREs, biopsy, and possibly mpMRI or watchful waiting for patients deemed not suitable for active treatment with curative intent by their treating clinician. Higher risk cancers may be treated with radical prostatectomy (RP), external beam or interstitial (brachytherapy) radiotherapy, androgen deprivation therapy, or a combination of these. Newer focal therapies are under investigation.³

Material and methods

This Comparative study was carried out in the Department of Radio Diagnosis, Katihar Medical College, Katihar (Al-Karim University), Bihar, India for 1 year. after taking the approval of the protocol review committee and institutional ethics committee.

Inclusion criteria

Study group consist of Patients with age group of 35 to 75 years, with Serum PSA greater than 4.0 ng/dl.

Exclusion criteria

Patients with prior prostatic biopsy or surgery ,patient with prostatitis ,prostatic abscess , patient with bone metastasis and patients with coagulopathies are excluded.

Methodology

After adequate bowel preparation and antibiotic prophylaxis ,all patients underwent 1.5 Tesla Multiparametric MRI with endorectal coil and Grey scale ultrasonography followed by Strain elastography of prostate using GE-Logic S7 machine. All patient underwent TRUS biopsy based on the MRI and elastography images(number of cores based on the suspected lesion: Average – 4), followed by TRUS guided extended core biopsy (13 cores) done by radiologist randomly. About 60 patients were included for the study. Out of 60 cases 6 patients were not willing to do mpMRI and 4 patient had claustrophobia in MRI room. Only remaining 50 patients underwent biopsy . All biopsy samples were sent in separate containers for histopathology. Histopathology reports were analyzed for adenocarcinoma, Gleason pattern, score and number of cores positive. The rate of prostate cancer detection was compared between the two types of biopsies. Group A consisted of cores from MRI plus Elastography guided TRUS biopsy and Group B were cores from Extended core biopsy. Both group were compared.

Results

The mean age of patients was 63.71. The mean serum PSA for patients was 14.77 ng/dl (6.5 to 40.7). 20 cases presented with AUR and patients were catheterized. In Patients with catheter, it was easy to identify the urethra in TRUS and safely do biopsy without injuring the urethra. The mean size of prostate in all 50 patients was 51.77 mg (29 to 84 mg). The mean size of prostate and serum PSA of patients with carcinoma prostate were 14.9 mg and 18 ng/dl respectively. Prostatic carcinoma detection with extended core biopsy was 42% (n=21). The incidence of prostate cancer detection by MRI plus Elastography guided TRUS is 41 cases (82%).

Table 1: demographic profile of the patients

Age in years	Number of patients	Percentage
35-45	10	20
45-55	15	30
55-65	12	24
65-75	13	26
Mean age of the patients	63.71	
Mean serum PSA	14.77 ng/dl	

Table 2: Size of prostate

Parameter	Mean
Mean size of prostate	51.77 mg
Mean size of prostate with carcinoma prostate	14.9 mg
Mean size of serum PSA with carcinoma prostate	18 ng/dl

Table 3: Prostatic carcinoma detection

Prostatic carcinoma detection	Number of patients	Percentage
core biopsy	21	42
MRI plus Elastography guided TRUS	41	82

MRI plus Elastography guided TRUS biopsy method is considered to be statistically significant as the p value is 0.0369 (since $p < 0.05$) as obtained by fishers exact test. In our study majority of the patients had adenomatous hyperplasia (n=30,60%) as the HPE diagnosis, followed by adenocarcinoma (n=20,40%). The increased Gleason score by MRI guided TRUS biopsy method in relation to extended core biopsy method is considered to be statistically significant with a p value of 0.0167 as obtained by fishers exact test, since $p < 0.05$. In patients belonging to extended core biopsy group, 0% had maximum gleason score of 4+4 (n=0). In MRI plus elastography guided TRUS biopsy group, 40% had maximum gleason score of 4+4 (n=6).

The sensitivity of mpMRI plus Elastography image based TRUS biopsy method in detecting Prostate cancer was 84.5% and specificity was 82%. The positive predictive value of this method was found to be 80%.

Discussion

Neoplastic cells have greater cell density that alters the tissue elasticity and stiffness.⁶ This principle is used in real time elastography. Currently available Elastography techniques can be categorized by the measured physical quantity. 1. strain imaging, and 2. shear wave imaging. Here in this study the Strain elastography was used and its diagnostic value in prostate malignancy was evaluated. In this study, about 50 patients who fulfilled the inclusion criteria were included in the study. All 50 patients underwent both mpMRI plus elastography guided TRUS biopsy and extended core biopsy. Out of the 50 patients, only 21(42%) patients who

underwent extended core biopsy were found to be cancer positive on histopathological examination. In comparison, 41 (82%) patients who underwent mpMRI plus Elastography image based TRUS biopsy were found to be cancer positive on HPE. The sensitivity of mpMRI plus Elastography image based TRUS biopsy method in detecting Prostate cancer was 84.5% and specificity was 82%. The positive predictive value of this method was found to be 80%.

Kasivisvanathan et al.⁷ studied and carried out MRI guided prostate biopsy in 182 patients and they reported a sensitivity of 95% and a specificity of 90%. Haffner et al.⁸ studied and carried out MRI- TRUS biopsy in 555 men with suspected malignancy and reported a sensitivity of 80% and specificity of 75%. Whereas Cochlin et al.⁹ reported that RTE had a sensitivity of 51% and a specificity of 83% for detecting prostate cancer in individual patients, and a sensitivity of 31% and specificity of 82% for detecting individually biopsied areas of the prostate. The sensitivity and specificity of extended core biopsy in this study is 20% and 82% and positive predictive value of 71%. Around 54% of biopsy positive patients had an upgrading of the Gleason score that is the patient who had lower Gleason score on extended core biopsy, had higher Gleason score on mpMRI plus elastography image based TRUS biopsy. A study by Siddique et al.¹⁰ showed an Gleason upgrading by 42% in their study which compared TRUS biopsy with MRI fusion biopsy. Prostate cancer lesions can be isoechoic by TRUS, two common forms of prostate pathology (prostatitis and BPH) can mimic the TRUS appearance of prostate cancer and TZ cancers are difficult to detect.¹¹ Hence to evaluate this populations it could be better to go with mpMRI with real time elastography. RTE can be used to illustrate tissue elasticity adequately to a depth of 5 cm, but we think that for BPH, and in the lateral part of the elastograms, and with increasing depth of US, many 'stiffness artefacts' are detectable. Tilting the US probe should be helpful in overcoming these 'lateral stiffness artefacts', but the 'deep stiffness artefacts' with increasing depth of TRUS could be overcome with MRI images.¹²

Conclusion

Although mpMRI and Elastography are individually useful for detection of prostate malignancy, combining both the diagnostic tools for TRUS guided increases the rate of cancer detection than that of extended core biopsy. This also upgrades the Gleason score and sum also.

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