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Original Research Article

Elastography plus MRI image-based TRUS biopsy versus extended core biopsy for prostate cancer detection and diagnosis

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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, RVM Institute of Medical Sciences & Research Centre for the period of 9 months. 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.

Results: The mean age of patients was 64.71. The mean serum PSA for patients was 14.70 ng/dl (6.5 to 40.7). 20 cases presented with AUR and patients were catheterized. The mean size of prostate was 51.07 mg (29 to 84 mg). The mean size of prostate and serum PSA of patients with carcinoma prostate were 14.1 mg and 18.4ng/dl respectively. Prostatic carcinoma detection with extended core biopsy was 42% (n=21). The incidence of prostate cancer detection by MRI plus Elastrography guided TRUS is 41 cases (82%). MRI plus Elastrography 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: Even while mpMRI and Elastography are each useful alone for detecting prostate cancer, using both diagnostic methods together for TRUS guided enhances the likelihood of cancer diagnosis over extended core biopsy.

Keywords: mpMRI and elastography, prostrate, biopsy

Introduction

Prostate cancer, the most common disease among men in the developed world, presents significant challenges [1]. Despite its widespread prevalence, only a small percentage of men

will succumb to its effects [2-4]. There is still a long way to go before we can accurately predict which cancers will kill males in a given demographic. With increased awareness of prostate cancer over-diagnosis and over-treatment, this critical issue is receiving a lot of attention.

For many years, transrectal ultrasound (TRUS)-guided biopsies sampling 6-12 cores, 1-2 for each sextant, have been the gold standard for diagnosing prostate cancer. This methodical approach resulted in a simple, relatively easy urology office-based test. The ultrasound images provide the physician with excellent guidance regarding gland size and boundaries, but limited information regarding internal glandular tissue and little or no detail on focal lesions. To maximise the ability to sample the peripheral zone, prostate tissue samples are obtained in a targeted manner using a needle aimed through the rectum. During TRUS biopsy, many areas, particularly the anterior gland, are frequently not sampled. The method also has a risk of post-biopsy infection (rates 4-10%) and is incapable of detecting and diagnosing clinically significant cancers [5-7].

Prostate MRI is now recognized as the most useful and accurate modality to detect, characterize and stage prostate cancer. Through combining different MRI-based techniques (T1-weighted [T1W], T2-weighted [T2W], diffusion-weighted imaging [DWI] and dynamic contrast enhanced imaging, [DCE]) it has become an increasingly utilized tool for prostate cancer diagnosis and staging. Now most centers performing prostate MRI use the multiparametric (mpMRI) approach [8, 9].

Hence the present study was conducted to evaluate the diagnostic accuracy for prostate cancer detection between elastography plus MRI image based TRUS biopsy versus extended core biopsy.

Material and Methods

This Comparative study was carried out in the Department of Radio Diagnosis RVM Institute of Medical Sciences & Research Centre, India for the duration of 1 year, after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient.

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 patients had claustrophobia in MRI room. Only remaining 50

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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.

Results

The mean age of patients was 64.71. The mean serum PSA for patients was 14.70 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 51.07 mg (29 to 84 mg). The mean size of prostate and serum PSA of patients with carcinoma prostate were 14.1 mg and 18.4 ng/dl respectively. Prostatic carcinoma detection with extended core biopsy was 42% (n=21). The incidence of prostate cancer detection by MRI plus Elastrography 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	64.71	
Mean serum PSA	14.70 ng/dl	

Table 2: Size of prostate

Parameter	Mean
Mean size of prostate	51.07 mg
Mean size of prostate with carcinoma prostate	14.1 mg
Mean size of serum PSA with carcinoma prostate	18.4 ng/dl

Table 3: Prostatic carcinoma detection

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

MRI plus Elastrography 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%.

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Discussion

Only 21 (42%) of the 50 patients in the current study who had extended core biopsy had cancer, according to histopathological analysis. In contrast, HPE results for 41 (82%) of the patients who had mpMRI plus Elastography image-based TRUS biopsy revealed malignancy. The mpMRI plus Elastography image-based TRUS biopsy approach had a sensitivity of 84.5% and a specificity of 82% for diagnosing prostate cancer. This method's positive predictive value 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 Siddhique *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

Transrectal ultrasound guided biopsy is still the most often used guidance modality for identifying prostate cancer, despite the fact that the process is carried out methodically without the direct visualisation of problematic lesions. The most popular non-invasive method for finding prostate cancer, on the other hand, is magnetic resonance imaging (MRI), which is also increasingly being used to direct targeted prostate biopsies. The rate of cancer identification across extended core biopsy is increased when mpMRI and elastography are used together, even though each diagnostic method is effective for detecting prostate cancer on its own.

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