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Prostate cancer Detection and Diagnosis: Elastographyplus MRI image-based TRUS biopsy versus extended core biopsy

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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, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti, Solan, Himachal Pradesh, India for the period of 6 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 Elastographyguided TRUS biopsy and Group B were cores from extended core biopsy.

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, prostrate, biopsy

Introduction

Public health issues like prostate cancer pose significant obstacles, since it is the most common disease among men in the industrialised world[1].Despite the great prevalence of the condition, only a tiny percentage of men will succumb to its effects (2-4 percent). There is still a long way to go before we can accurately predict which malignancies will kill males in a certain demographic. With the growing awareness of prostate cancer's over-diagnosis and over-treatment, this essential issue is receiving a lot of attention.

Transrectal ultrasound (TRUS)-guided biopsies sampling 6-12 cores, 1-2 for each sextant, has been the diagnostic standard for prostate cancer for many years. This systematic approach has provided a simple, relatively easy, urology office-based test. The ultrasound images provide

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excellent guidance to the physician as to the gland size and boundaries but limited information regarding internal glandular tissue and little or no detail on focal lesions. The prostate tissue samples are obtained in a directed way via a needle aimed through the rectum to optimize the ability to sample the peripheral zone. Many areas, particularly the anterior gland, frequently are not sampled during TRUS biopsy. The method also has a possible risk of post-biopsy infection (rates 4-10%) and suffers from an inability to detect and diagnose 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, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti, Solan, Himachal Pradesh, India for the period of 6 months, 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 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 Elastographyguided TRUS biopsy and Group B were cores from extended core biopsy.

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

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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.

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 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 frequently used guidance modality for diagnosing prostate cancer, although the procedure is performed in a systematic way, without direct visualization of suspicious lesions. On the other hand, MRI is currently the most widespread technique to detect prostate cancer noninvasively and is being increasingly used to guide targeted prostate biopsies. 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.

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