Original Article

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Radiology Section

Assessment of TRUS (with Colour Doppler) and MRI with TRUS Guided Biopsy in Prostatic Lesion Diagnosis – A Comparative Study

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ABSTRACT

Introduction: Prostatic gland lesions are becoming an alarming health hazard among Indian males. Early diagnosis and risk prediction are crucial for accurate treatment decisions. TRUS and MRI are effective in the diagnosis of prostatic lesions.

Aim: To assess the role of Transrectal ultrasound (TRUS) with colour doppler and Magnetic Resonance Imaging (MRI) in prostatic lesion detection with reference to TRUS guided biopsy.

Materials ad Methods: A total 100 cases with chief complaints of prostatic enlargement were included. Study participants underwent MRI, TRUS and TRUS guided biopsy. Collected data was analysed by using SPSS statistical software version 16.0. Lesion diagnostic efficacy was represented in terms of sensitivity, specificity, accuracy, Positive Predictive Value (PPV) and Negative Predictive Value (NPV).

Results: The mean age of cases was 71.53 years. 59% cases had Benign Prostatic Hyperplasia (BPH), 10% cases had prostatic abscess. Histopathological results showed 80 cases had benign and 13 cases had malignant lesions and rest had inconclusive lesions which means echotexture of the lesion was complicated to judge by the experts and such lesions was avoided for HPE. The main associated clinical symptoms were nocturia (39%), hesitancy (18%) and acute retention (14%). TRUS with colour Doppler detected 13 malignant lesions, among them 10 characterised with increased vascularity whereas in benign 2 lesions showed increased vascularity. MRI was failed to detect few nodular lesions which was confirmed by TRUS. TRUS has lesion detection sensitivity 88.2% and specificity 95.4%. MRI has lesion detection sensitivity 76.8% and specificity 99.7%.

Conclusion: MRI was sensitive than TRUS in detection of transcapsular extensions. TRUS is effective in differentiation of malignant and benign prostatic lesions whereas MRI is better in localising the lesions. TRUS with colour doppler was able to visualise vascular lesions promptly when compared to the MRI.

Keywords: Benign tumours, Malignant tumours, Prostate gland, Sensitivity, Specificity

INTRODUCTION

Prostate gland lesions are the second commonest cancer in males, globally. In India, the estimated incidence of prostatic cancers for the period 2010 was 26,120 cases, 2015 was 28,079 cases and 2020 will be 30,185 cases with 36% mortality rate [1,2]. There is a constant increase in incidence (range 20% to 100%) of prostatic cancers in five major cities of India such as Delhi, Mumbai, Chennai, Bangalore and Bhopal [3]. Multiple factors influencing prostatic lesion occurrence such as age, ethnicity, genetic background, dietary factors [4]. Prostatic lesion incidence is linked to age. It is commonly observed in men above 50 years age [5,6]. Early diagnosis (lesion extent, type and echogenicity) and treatment to lesions is important for patient survival [7].

The prostatic lesion detection and treatment is a challenging task for the clinicians. Various screening methods like Digital Rectal Examinations (DRE), serum Prostate Specific Antigen (PSA) TRUS, TRUS with colour doppler and MRI are available. The serum PSA with random unguided biopsy has gained disappointing clinical outcomes in lesion detection [8]. TRUS is an effective diagnostic modality which needs more detail evaluation.

TRUS with colour doppler is effective in visualising the detailed vascular architecture of prostatic lesions. TRUS and TRUS guided prostate biopsy is the gold standard method for prostate lesion detection [9]. MRI and MRI guided prostatic biopsy may play notable role in the detection, localisation and staging of prostatic lesions [10]. According to the literature, few studies raised an issues on colour doppler in view of its resolution [9]. In multifocal cases MRI based prostatic lesion diagnosis cannot be considered as effective because of its poor sensitivity [11].

With reference to the above literature this study was designed to assess the diagnostic efficacy of TRUS and MRI with TRUS guided biopsy in cases with prostatic lesions.

MATERIALS AND METHODS

The present prospective study was conducted in Department of Radiodiagnosis, Dr. BR Ambedkar Medical College, Bangalore Karnataka, India, during April 2017 to June 2018. A total 100 cases with chief complaints of prostatic enlargement and prostatic nodules were included. Cases with diffusely enlarged prostate gland as per DRE, enlarged prostate gland with high tenderness and prostate with hard prostatic nodules were included. Cases who were not willing to participate and unable to lie in positions were excluded from the study. Informed consent was obtained from all the study participants and work protocol was approved by institutional ethics committee (AMC/IEC/2016/83).

All cases underwent MRI, TRUS and TRUS guided biopsy. Transrectal sonography was performed using ALOKA -3500 equipped with 7.5 MHz biplanar transrectal probe. Before TRUS, all the cases underwent Trans abdominal USG to evaluate prostatic feature. Probe was inserted until seminal vesicles and then examined prostate in multiple axial sections. MRI was done using SIEMENS 1.5T superconducting magnetom, using CP spine array coil, colour doppler was also used in evaluating the lesions. Axial, sagittal, coronal high spatial resolution turbo spin echo T2 weighted sequence were obtained with TR/TE –

4000ms/101ms, with 5 mm slice thickness, FOV 200 mm and with 12-16 slices to assess extracapsular extensions. Cases suspected with malignant lesions were referred for transurethral resection and then sent for histopathological examination. After one week of MRI evaluation cases were subjected to TRUS guided biopsy. Based on the sonographic appearance of prostate cases were classified in to five groups.

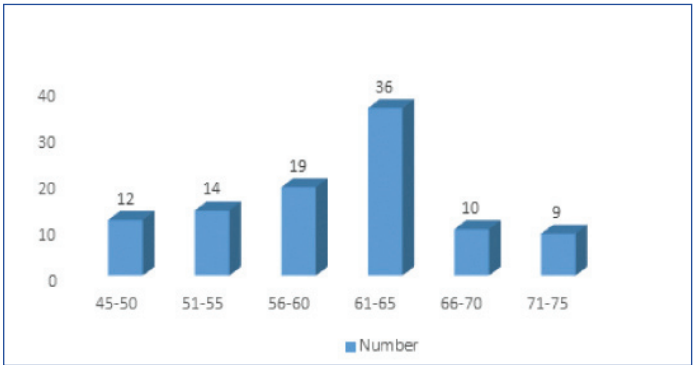
Group	Features
I	Prostate with homogenous echotexture
II	Prostate with inhomogenous echotexture
III	Prostate with nodular lesions
IV	Prostate with cystic areas
V	Prostate with cystic lesions without septations

STATISTICAL ANALYSIS

Four senior radiologists available in the Department of Radiology, Dr BR Ambedkar Medical College analysed and qualitatively assess the MRI. Collected data was analysed by using SPSS statistical software version 16.0. To compare the data chi-square test and t-test was used. Lesion diagnostic efficacy was represented in terms of sensitivity, specificity, accuracy, PPV and NPV.

RESULTS

Majority of the cases were between age group 61-65 years (36%) followed by 56-60 years (19%) [Table/Fig-1]. Based on sonographic appearance majority cases were in group I (64%) followed by group III (13%), group II (10%), group IV (8%) and group V (5%) [Table/Fig-2].



[Table/Fig-1]: Age wise distribution of cases.

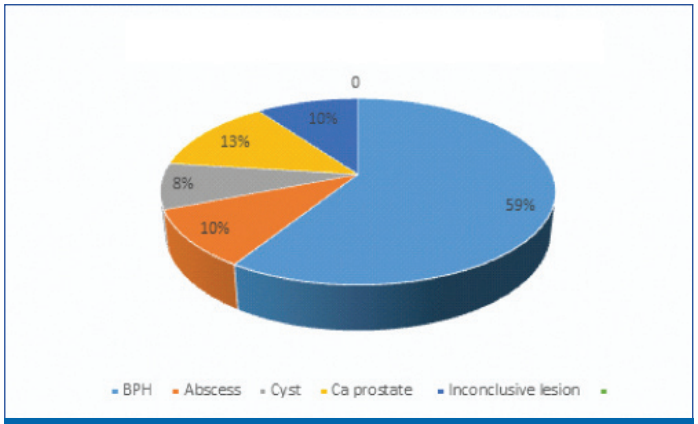
Group	Total cases	
	Number	Percentage
Group I	64	64%
Group II	10	10%
Group III	13	13%
Group IV	08	8%
Group V	05	5%

[Table/Fig-2]: Distribution of cases based on TRUS appearance of prostate.

BPH was seen in 59% cases, prostatic abscess in 10% cases where as 10% cases had inconclusive lesions which means echotexture of the lesion was complicated to judge by the experts and such lesions was avoided for HPE [Table/Fig-3]. The main associated clinical symptoms are shown in [Table/Fig-4].

Hypoechoic lesion was seen in 88.12% cases, Hyperechoic lesions in 1.69% cases and isoechoic lesions in 11.86% cases. TRUS with Colour Doppler detected 13 malignant lesions, among them 09 characterised with increased vascularity whereas in benign 06 lesions showed increased vascularity [Table/Fig-5].

TRUS has lesion detection sensitivity 88.2%, specificity 95.4%, accuracy 95%, Positive predictive value 78% and Negative predictive value 96% [Table/Fig-6]. MRI has lesion detection sensitivity 76.8%,



[Table/Fig-3]: Distribution of cases based on type of the prostatic lesion.

Clinical symptom	Total cases	
	Number	Percentage
Haematuria	07	7%
Nocturia	39	39%
Hesitancy	18	18%
Urgency	10	10%
Acute retention	14	14%
Poor stream	12	12%

[Table/Fig-4]: Clinical symptoms of the cases.

	HPE		
	Malignant	Benign	Inconclusive
Group 1 (n=64)	00	64	00
Group 2 (n=10)	06	03	01
Group 3 (n=13)	04	08	01
Group 4 (n=8)	02	05	01
Group 5 (n=5)	01	00	04
Increased vascularity	09	06	-
Transcapsular extension			
TRUS	01		
MRI	05		
Echogenicity of prostatic lesions (BPH)			
Hypoechoic	52 (88.12%)		
Hyperechoic	01 (1.69%)		
isoechoic	07 (11.8%)		
Prostatic zone affected by lesions (Malignant=13)			
Transition zone	03 (23%)		
Peripheral zone	10 (76.9%)		

[Table/Fig-5]: Findings of TRUS, MRI and HPE in cases with prostatic lesions.

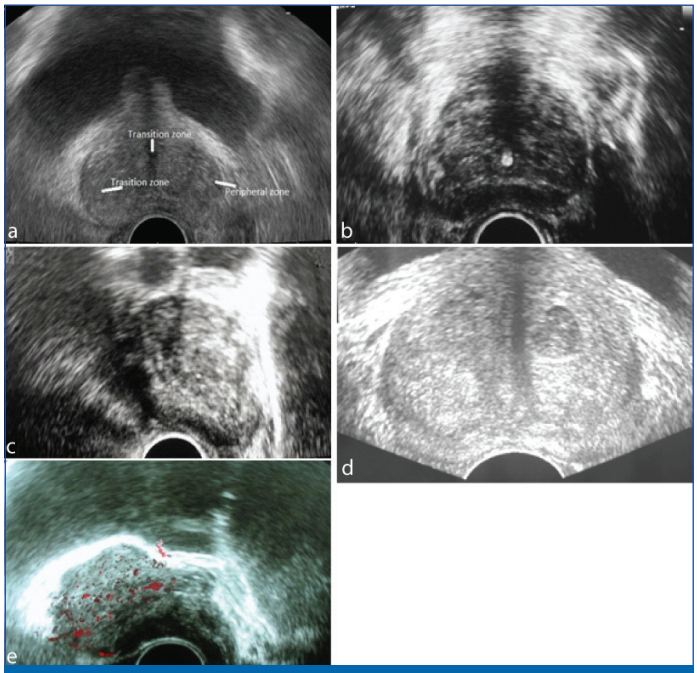
specificity 99.7%, accuracy 95.8%, Positive predictive value 98% and Negative predictive value 93.2% [Table/Fig-6]. [Table/Fig-7and 8] shows TRUS and MRI findings of prostatic lesions showing BPH, Prostatic carcinoma.

DISCUSSION

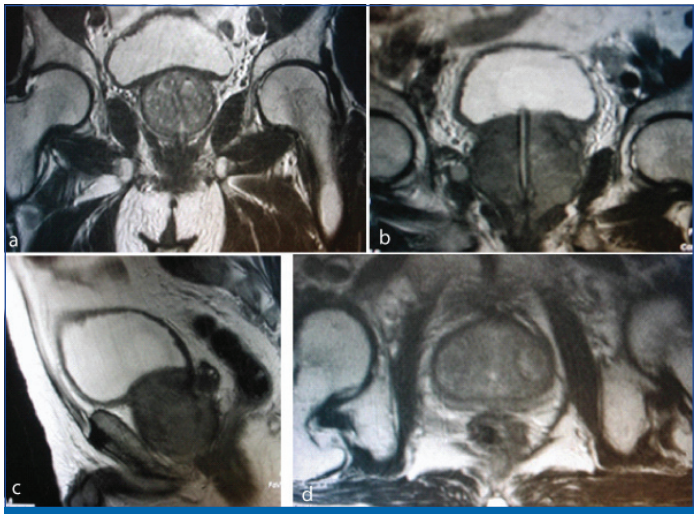
Lesions to the prostate gland are most common in Indian males. The incidence of prostatic cancers is rapidly increasing in India. In Delhi incidence was 10.66 per 100000 peoples, whereas incidence of whole country was 3.7/100000 peoples during year 2008 [12]. Transrectal ultrasonography and TRUS guided biopsy are widely accepted diagnostic modalities for the prostatic lesion detection [3]. Prostate on TRUS appears as a homogenous, with uniform and low level echoes. MRI is an effective imaging modality for prostatic lesion detection but has less specificity. This study was designed to assess the efficacy of TRUS with colour doppler and MRI with TRUS guided biopsy in cases with prostatic lesions. A total 100 cases with

	TRUS VS HPE	MRI VS HPE
False positive rate	09	00
False negative rate	12	35
Accuracy	95%	95.8%
Sensitivity	88.2%	76.8%
Specificity	95.4%	99.7%
Positive predictive value	78%	98%
Negative predictive value	96%	93.2%
Chi-square value	0.41	2.26
p-value	p=1.18	p=0.66

[Table/Fig-6]: Diagnostic efficacy of TRUS with colour Doppler against HPE and MRI against HPE in prostatic lesion cases.



[Table/Fig-7]: Transrectal ultrasonography showed: a) Benign prostatic hyperplasia (Axial plane); b) Prostatic carcinoma (Axial plane); c) Prostatic carcinoma (Sagittal plane); d) Nodular Benign prostatic hyperplasia (Axial plane); e) Hyper-vascular prostatic lesion.



[Table/Fig-8]: MRI findings of prostatic lesions showing: a) Benign prostatic hyperplasia (T2 coronal plane); b) Prostatic carcinoma (T2 coronal plane); c) Prostatic carcinoma (T2 Sagittal plane); d) Nodular Benign prostatic hyperplasia (T2 WI Axial plane).

chief complaints of prostatic lesions were recruited. Khanduri S et al., noted that mean age of study participants was 63.80 years [13]. Study by Lee F et al., found mean age 69 years in their study [14].

In the present study 59% cases had BPH, 10% cases had prostatic abscess [Table/Fig-3]. The main associated clinical symptoms are nocturia (39%), hesitancy (18%) and acute retention (14%) [Table/Fig-4]. Study by Khanduri S et al., on 50 prostatic lesion cases found Hypoechoic lesions in 22 cases (44.44% benign, 76.92% malignant), Isoechoic to hypoechoic in 17 cases (51.85% benign and 23.08% malignant) and Isoechoic lesion in 1 case (3.7% benign and no malignant) [13]. In this study hypoechoic lesion were seen in 88.12% cases, Hyperechoic lesions in 1.69% cases and isoechoic lesions in 11.86% cases [Table/Fig-5].

Study by Sinohara K et al., stated that surface irregularities of prostate always misleads to the existence of malignancy even though in absence [15]. In this study, due to surface irregularity 2 isoechoic nodule were identified and misinterpreted as malignancies. Study by Shingeno K et al., stated that TRUS with colour doppler detects highly vascular malignant lesion very accurately [16]. TRUS with colour doppler detected 13 malignant lesions, among them 10 characterized with increased vascularity whereas in benign 2 lesions showed increased vascularity. TRUS with colour doppler was able visualise vascular lesions promptly when compare to the MRI [17].

In this study among 13 malignant lesions 10 were seen in peripheral zone and 3 were in transition zone. In this study TRUS detected hypoechoic and homogeneous lesion in peripheral zone had surface irregularities. Lesion with surface irregularity in peripheral zone is an indication to malignancy. TRUS has lesion detection sensitivity 88.2%, specificity 95.4%, accuracy 95%, PPV 78% and NPV 96% [Table/Fig-6]. Lavoipierre AM et al., in their study noted that doppler sonography in lesion detection has true positive value 44%, false positive value 56%, true negative value 61% and false negative value in 29% [18].

MRI was effective in detection of hypoechoic prostatic lesion in peripheral zone in Transitional Zone Weighted Images (TZWI) which is an indication to malignancy. It was better in identification of lesion extension, whereas in this study MRI failed to detect few nodular lesions which was confirmed by TRUS. MRI has lesion detection sensitivity 76.8%, specificity 99.7%, accuracy 95.8%, Positive predictive value 98% and Negative predictive value 93.2% [Table/Fig-6].

Study by Yadav P et al., noted MRI has lesion detection sensitivity 92.3% and specificity (94.4%) [10]. Study by Jagannathan D et al., in their study found sensitivity 94.7%, specificity 42.9%, accuracy 80.8%, PPV 81.8% and NPV 75%[12]. In this study MRI detected 5 cases with transcapsular extension whereas TRUS detected only 3 cases. Studies suggested that MRI was sensitive than TRUS in detection of transcapsular extensions [19,20].

LIMITATION

This study was conducted with minimal sample size and further studies are needed to compare the present findings with more sample size.

CONCLUSION

Prostatic lesions are becoming major health hazard in the Indian males. This study focused on comparison of TRUS and MRI in detecting prostatic lesions. TRUS is better in differentiation of malignant and benign prostatic lesions whereas MRI is better in localize the lesion. MRI was sensitive than TRUS in detection of transcapsular extensions. TRUS with colour doppler was able visualise vascular lesions promptly when compared to the MRI. TRUS is better than MRI in prostatic lesion detection may be because of body coil used in MRI. TRUS is best method to perform guided biopsy and is better diagnostic modality than MRI due to less exposure to the radiation and available at all centres.

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