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## ORIGINAL RESEARCH

# Comparison between Transrectal Ultrasonography and Magnetic Resonance Imaging in patients with Lower Urinary Tract Symptoms and elevated Serum PSA levels

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**Abstract**

**Background:** Lower Urinary Tract Symptoms (LUTS) constitute a salient proportion of urological consultations in males. There is significant concurrence among Benign Prostatic Hyperplasia (BPH), chronic prostatitis and prostate cancer vis-a-vis clinical presentation, radiological imaging and PSA levels. The present study was a cross sectional study to understand correlation between TRUS and MRI findings in patients with elevated serum PSA levels.

**Materials and methods:** The study was done on 40 patients with LUTS and elevated serum PSA levels (>4ng/ml). These patients were subjected to both TRUS and MRI.Patients showing imaging features suspicious for carcinoma prostate were subjected to TRUS guided biopsy and histopathological evaluation was done.

**Results:** The largest number of cases i.e., 17 (42.50%) were of 66-75 years age group. The highest number of participants i.e., 24 (60%) had PSA levels in 10-20 ng/ml range. The average prostate volume calculated by TRUS was 31.3 ml and by MRI was 33.2 ml. Abnormalities of the central gland/ transition zone were found in 39(97.5%) patients on TRUS. Abnormalities of the central gland/ transition zone were found in all 40 (100%) cases on T2WI and 20 (50%) cases on DWI/ ADC. Abnormalities of the peripheral zone were found in 5 (12.5%) cases on TRUS. Abnormalities of the peripheral zone were found in 7 (17.5%) cases on DWI/ADC and 28 (70%) cases on T2WI. Overall, in our study 32 out of 40 patients were provisionally diagnosed as benign prostatic pathology and 8 patients as cases of prostate carcinoma on radiological imaging.

**Conclusion:** In our study, it was found that the chances of malignancy increase with rising PSA levels especially significantly after 20ng/ml. MRI was found to be better than TRUS in the assessment of prostatic parenchyma and consequently in differentiating between benign and prostatic carcinoma.

**Keywords**: Benign Prostatic Hyperplasia, Prostate Carcinoma, PSA

## Introduction

Lower Urinary Tract Symptoms (LUTS) constitute a salient proportion of urological consultations in males, especially the elderly. In men younger than 50 years, chronic prostatitis / chronic pelvic pain syndrome (CPPS) is the leading cause of visits to a urologist

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and in men older than 50 years, it is the third most common cause.[1,2]There is significant concurrence among Benign Prostatic Hyperplasia (BPH), chronic prostatitis and prostate cancer vis-a-vis clinical presentation, radiological imaging (TRUS and MRI) and PSA levels. Therefore, the role of imaging assumes significance. TRUS and MRI are the leading investigations for the diagnosis and management of prostatic pathologies. In many situations, these investigations can differentiate between benign pathologies (eg., BPH), and malignant etiologies (eg., carcinoma) with a fair degree of accuracy. TRUS being easily available is usually the first imaging investigation in patients with raised serum PSA levels followed by MRI in case of suspicious findings being reported on ultrasonography.

**Objectives**

To study the correlation between TRUS and MRI findings in patients with elevated serum PSA levels to enhance our understanding of diverse prostatic pathologies

1. To assess the role of TRUS in patients with elevated serum PSA levels(> 4 ng/ml)
2. To assess the role of MRI in patients with elevated serum PSA levels(>4 ng/ml)
3. To compare the findings on TRUS and MRI
4. To differentiate benign prostatic diseases from prostatic carcinoma

**Materials and methods**

The present study was a cross sectional study with a duration of 2 years. The study was done on 40 patients presenting to Department of Urology, Government Medical College, and Rajindra Hospital Patiala with lower urinary tract symptoms and were found to have elevated serum PSA levels(>4ng/ml). These patients were the referred to the Department of Radiodiagnosis for imaging and were subjected to both trans rectal ultrasonography(TRUS) and MRI. The patients were well informed about the study procedure and written informed consent was taken. TRUS was done by C8-4v broadband curved array probe (Philips HD 11 XE). MRI imaging was done by a 1.5 T superconductive scanner (Siemens 1.5 T Magneton Aera MRI machine).

**Inclusion Criteria**

1. Patients with elevated serum PSA levels (>4ng/ml).
2. Patients who gave consent for TRUS and MRI imaging and were willing to enrol in the study.

**Exclusion Criteria**

1. Patients not willing to undergo TRUS and MRI.
2. Patients with MRI incompatible devices and other contraindications of MRI.

Patients showing imaging features suspicious for carcinoma prostate were subjected to TRUS guided biopsy and histopathological evaluation was done for confirmation of the radiological diagnosis.

**Statistical Analysis**

The results of observations of individual patients were pooled and analyzed. Statistical analysis was performed using the Statistical Program for Social Sciences (SPSS) software version 20.0 Chicago, Illinois, USA. Descriptive statistics had been applied for the analysis of data. Data were expressed in proportion and percentage form and represented in the form of tables, charts, and bar diagrams.

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**Results**

In the present study, 40 patients were included and divided into 4 age groups. The largest number of cases i.e. 17 (42.50%) were of 66-75 years age group and only 2 (5%) patients belonged to the age group of 76 yrs. and above. Thirteen (32.50%) patients were of the age group of 56 to 65.65 yrs. The mean age of patients was 63.44 yrs. with a standard deviation of 8.57.

The highest number of participants i.e. 24 (60%) had PSA levels in 10-20 ng/ml range, followed by 11(27.5%) in 4-10ng/ml range and 4 (10%) in 20-30 ng/ml range respectively. There was only 1 participant in > 30ml range with a serum PSA level of 32ng/ml. Mean serum PSA levels of 13.8 ng/ml was observed.

40 participants in the present study were divided into three groups based on prostatic volume by TRUS viz 20-30 ml, 30-40 ml, and >40 ml. 22 (55%) patients were in the 20-30 ml range whereas 15 patients (37.5%) had volumes in 30-40 ml range. Only 3 (7.5%) patients had prostate volumes >40 ml. Patients were divided into three groups based on MRI estimation of prostate volume. Most number of patients i.e. 18 (45%) had prostatic volume ranging between 30-40 ml whereas least number of patients i.e. 7 participants (17.5%) had prostatic volume >40 ml. 20-30 ml group had 15 patients (37.5%) The average prostate volume calculated by TRUS was 31.3 ml and by MRI was 33.2 ml. On statistical analysis, no statistical difference was found between prostate volumes calculated via TRUS and MRI.

Abnormalities of the central gland/ transition zone were found in 39 (97.5%) out of 40 patients on TRUS. Abnormalities of the central gland/ transition zone were found in all 40 (100%) cases on T2WI and 20 (50%) out of 40 cases on DWI and ADC sequences. On statistical analysis, a significant difference was found between assessment of central gland/transition zone on TRUS and MRI implying that MRI was better in the assessment of central gland/transition zone.

Abnormalities of the peripheral zone were found in 5 (12.5%) out of 40 cases on TRUS. Abnormalities of the peripheral zone were found in 7 (17.5%) cases on DWI/ADC and 28 (70%) out of 40 cases on T2WI. On statistical analysis, a significant difference was found between assessment of peripheral zone on TRUS and MRI implying that MRI was better in the assessment of peripheral zone.

Overall, in our study 32 out of 40 patients were provisionally diagnosed as benign prostatic pathology on radiological imaging, Out of these, 21 patients had S. PSA levels between 4-10 ng/ml and 11 had S. PSA levels ranging between 11-20ng/ml. Rest 8 patients were provisionally labelled as cases of prostate carcinoma. Out of these, 3 patients had S. PSA levels between 11-20ng/ml, 4 had S. PSA levels between 21-30ng/ml while 1 patient had S. PSA above 30ng/ml.

| **S. PSA levels (ng/ml)** | **Benign** | | **Malignant** | |
|---|---|---|---|---|
| | **Number** | **Percentage** | **Number** | **Percentage** |
| 4-10 | 21 | 65.63% | 0 | 0% |
| 11-20 | 11 | 34.37% | 3 | 37.50% |
| 21-30 | 0 | 0% | 4 | 50% |
| >30 | 0 | 0% | 1 | 12.50 |
| Total | 32 | 100% | 8 | 100% |

***Table 1*** showing the number and percentage of radiologically diagnosed benign and malignant prostatic lesions in patients with various ranges of Serum PSA levels

All the 8 patients suspicious for malignancy on radiological imaging, subjected to TRUS guided biopsy were confirmed to have carcinoma prostate on histopathology.

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**Discussion**

Benign prostatic pathologies and prostatic cancer often present a similar clinical picture which makes the clinical diagnosis difficult. With the advent of newer imaging techniques, the diagnosis is fairly dependent on ultrasonography and magnetic resonance imaging. Early diagnosis can not only aid in better treatment but also decrease morbidity and mortality to a great extent. The present study was conducted to study the correlation between transrectal ultrasonography and MRI in patients with lower urinary tract symptoms and elevated serum PSA levels.

In our study, the age of patients enrolled was between 46 to 77 years. The mean age of patients in the study was 63.4 years .Similar results were observed in a study published by Turkbey et al. (2012) over 500 patients with elevated PSA levels who underwent MRI with a mean age of study being 60.5 years,[3] Bansal et al. (2017) did a study on TRUS MRI fusion biopsy in patients with suspected prostate cancer with the mean age of study being 64.4 years.[4]

On comparison of prostate volumes by TRUS and MRI estimations, it was found that TRUS estimation had a maximum number of patients (22) in the 20-30 ml bracket whereas MRI estimation had maximum patients (18) in the 30-40 ml bracket. Both transrectal ultrasonography and MRI estimates had a minimum number of patients in >40 ml category. On statistical analysis, no statistical difference was found between prostate volumes calculated via TRUS and MRI estimations. Taylor et al. (2014) did a retrospective analysis on prostate volume estimations using different methods including TRUS, MRI and CT at which concluded that although there is a statistically significant difference between CT vs. MRI and CT vs. TRUS in prostate volume estimations, there is no statistically significant difference between prostate volume estimation by TRUS and MRI.[5] Martins et al. (2020) conducted a retrospective study on patients who underwent MRI and transrectal ultrasonography before undergoing radical prostatectomy and derived that prostate volume estimations by transrectal ultrasonography and MRI yielded similar results which were correlating with volumes calculated on surgical specimens. No statistically significant differences were found among prostate volume estimations by TRUS, MRI and radical prostatectomy specimens.[6]

On comparison of TRUS vs MRI for detection of central gland/transition zone lesions, it was found that the difference was statistically significant implying that MRI was better for detection of central gland/transition zone lesions in our study. Guneyli S. et al. (2016) in a retrospective analysis of MRI scans of BPH patients derived that due to its better soft tissue assessment, MRI is better than ultrasonography in differentiating benign prostatic hyperplasia from prostate cancer and further classification of BPH types.[7]Yasi Al et al. (2016) conducted a study on MRI in the diagnosis of histopathologically proven transition zone prostate cancer and concluded that MRI comprising both T2WI and DWI leads to sensitivity and specificity of 91% and 80% respectively for diagnosis of transition zone cancer.[8]

On comparison of TRUS and MRI for peripheral zone lesions, the difference was found to be statistically significant implying that MRI is better for the assessment of peripheral zone lesions in our study. Shimuzu et al. (2009) conducted a retrospective study on patients with elevated PSA who underwent TRUS and MRI examination followed by biopsy and radical prostatectomy for prostate cancer. MRI was found to have higher sensitivity for cancerous focus w.r.t transrectal ultrasonography.[9] Russo et al. (2016) conducted a study in which out of 115 patients of biopsy proven cancer, mp MRI was able to correctly diagnose 104 cases leading to a sensitivity of 90.4%.[10]

Overall, in our study 32 out of 40 patients were provisionally diagnosed as benign prostatic pathology on radiological imaging, Out of these, 21 (65.63%) had S. PSA levels between 4-

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10 ng/ml and 11 patients (34.37%) had S. PSA levels ranging between 11-20 ng/ml. Rest 8 patients were provisionally labelled as cases of prostate carcinoma. Out of these, 3 (37.50%) patients had S. PSA levels between 11-20 ng/ml, 4 (50%) had S. PSA levels between 21-30 ng/ml while 1 patient (12.50%) had S. PSA above 30ng/ml.

Kiehl et al. (2016)concluded that BPH and prostatitis is associated with elevated S. PSA levels when there is disruption in glandular epithelium.[11] A study by Lekili et al. showed 32% of prostate adenocarcinoma patients had serum PSA value >20 ng/ml.[12] In study by Banerjee et al.(1994), it was found that found 20% of adenocarcinoma had PSA values in the range of 0–7 ng/ml while 40% of adenocarcinomas had PSA values over 21 ng/ml. In another study done by Kamalesh waranet al. (2012), they found 24% of prostate adenocarcinoma patients with serum PSA >20 ng/ml.[13]

Matthew Gretzer and Alan Partin (2002) analyzed various studies based on serum PSA level and the probability of prostate cancer and derived that for serum PSA level between 4-10 ng/ml, the probability of prostate cancer ranges from 22-27% and for serum PSA level above 10 ng/ml, it rises sharply to 67%(55). In our study, the mean serum PSA level for probable cases of prostate cancer was 23.3ng/ml.[14] Kehinde et al. (2003) based on the findings of TRUS guided biopsy in patients with a serum PSA level of >10ng/ml, derived the prevalence of BPH at 68% and prostate cancer at 11% respectively.[15] Pujari (2013) performed TRUS guided biopsies on 172 patients with elevated serum PSA levels, out of which 9 (5.2%) had prostatic cancer and the remaining 163 (94.7%) had benign pathologies.[16]

## Conclusion

Imaging is the second step in assessment of prostatic complaints after serum PSA evaluation. Transrectal ultrasonography(TRUS) is usually the first imaging investigation employed followed by MRI. In our study, it was found that although both benign and malignant prostatic pathologies can cause elevation in S. PSA levels, but the chances of malignancy rises with rising PSA levels especially significantly after 20ng/ml. Though there was no statistically significant difference between TRUS and MRI in estimations of prostate volumes yet MRI was better than TRUS in the assessment of prostatic parenchyma comprising central gland/transition zone and peripheral zones and consequently in differentiating between benign causes (e.g. benign prostatic hyperplasia) and prostatic carcinoma.

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