



**ORIGINAL RESEARCH PAPER**

**Radiology**

**THE ROLE OF TRANS-RECTAL ULTRASONOGRAPHY IN DIAGNOSTIC EVALUATION OF DISEASES OF PROSTATE**

**KEY WORDS:** trans-rectal ultrasound, prostatitis, benign prostatic hyperplasia, prostatic cancer

**Dr. Kamran Hashmi**

Senior Resident, Department of Radiology Darbhanga Medical College and Hospital, Darbhanga Bihar

**Dr. Rakesh Mehra\***

Assistant professor Department of Radiology, Darbhanga Medical College and Hospital Darbhanga Bihar\*Corresponding Author

**Dr. Sanjay Jha**

Associate Professor and Head, Department of Radiology Darbhanga Medical College and Hospital, Darbhanga Bihar

**ABSTRACT**

Transrectal ultrasound (TRUS) is a short outpatient procedure that uses sound waves to create a video image of the prostate gland. A small, lubricated probe placed into the rectum releases sound waves, which create echoes as they enter the prostate. It remains the first modality of choice to image and biopsy the prostate. However, it has a poor accuracy in detection and staging of prostate cancer. It was first developed in the 1970s. TRUS-guided biopsy, under local anaesthetic and prophylactic antibiotics, is now the most widely accepted method to diagnose prostate cancer. An abnormal TRUS result may mean that a man has an enlarged prostate (called benign prostatic hyperplasia), an inflamed or infected prostate (called prostatitis) or prostate cancer. This study illustrates the importance of transrectal ultrasound in evaluation of various prostatic lesions

**Introduction**

In clinical practice, patients with prostatic diseases mainly present with a constellation of lower urinary tract symptoms. Common prostatic pathologies include benign prostatic hyperplasia, prostatic carcinoma, prostatitis, prostatic abscesses and prostatic cysts. The standard work-up for diagnosis of prostatic pathologies includes a comprehensive history, physical examination including digital rectal examination, relevant laboratory investigations, uroflowmetry and appropriate imaging studies. The introduction of high-resolution transrectal ultrasound transducers, tissue harmonic imaging and improved probe technologies has extended the purview of transrectal ultrasonography. Devices for attachment of biopsy guide facilitate guided biopsy. With these views in mind present study is being undertaken to evaluate the usefulness and accuracy of transrectal ultrasonography.<sup>1</sup>

**Aims and Objectives**

- Evaluation of patients presenting with prostate-related symptoms clinically including history taking, physical examination including digital rectal examination and necessary laboratory investigations.
- Evaluation of prostate gland of selected patients by trans-rectal ultrasonography.
- Confirmation of pathologies by other means like serum PSA estimation, biopsy, microbial cultures and clinical observations.
- Clinicopathological correlation of ultrasonographic findings will be evaluated to arrive at a conclusion.

**Materials and Methods**

**Patient selection**

Patients with the following complaints were considered for the study –

1. Male patients presenting with symptoms related with bladder outlet obstruction like difficulty in voiding, urinary retention, frequency of urination, hesitancy or dysuria.
2. Patients presenting with symptoms related with prostatic inflammation – perineal pain associated with fever, vague discomfort in perineum or external genitalia without any obvious cause, pain during ejaculation or hemospermia, recurrent symptoms of UTI.
3. Patients were initially screened with digital rectal

examination, serum PSA and urine for routine examination and culture.

4. Patients with the following criteria were selected –

- (1) Those having suspicious DRE and/or serum PSA > 4 ng/ml,
- (2) Patients with prostatic tenderness, urine containing significant pus cells (> 10 / HPF).

**The machine**

Images were obtained by an endoluminal end-viewing sector-array transducer having a frequency range of 6 – 7 MHz which allows for multiplanar imaging in semicoronal and axial projections. Images were seen in Logic P3 machines.

**Digital rectal examination:**

DRE is done with the patients in left lateral decubitus. The lubricated pulp of the index finger was laid flat upon the anal verge and firm pressure was applied until sphincter was felt to yield. Then with a rotatory movement the finger was slowly introduced. The finger was then placed in the anterior rectal wall. Prostate was palpated with its lateral lobes on both sides and a median furrow. The following features were noted –

- Any enlargement of prostate and whether it is symmetrical or asymmetrical.
- Consistency – hard or firm or cystic.
- Any nodularity.
- Persistence or obliteration of median furrow.
- Mobility of the gland.
- Tenderness over or around prostate.
- After matching the criteria patients were selected and examined by transrectal ultrasonography.

**Technique of Transrectal ultrasonography**

Patient preparation: Patients were advised for rectal cleansing with self-administered Enema to be applied in the morning of the day of examination. Patients were told to come with empty urinary bladder.

**Method proper**

- The ultrasound probe was prepared by covering it with sterile condom after instillation of ultrasound gel inside the condom. Gel is also applied over the condom cover.
- The patient was asked to void urine and then lie down in left lateral decubitus with knees and hips flexed 90° on the ultrasound table. The buttocks of the patient should be

flushed with edge of the table to allow manipulation of the probe.

- The transducer was introduced per rectum gently and manipulated by the handle to obtain images at different planes.

**Examination technique:** Images were obtained in axial and sagittal planes in a systematic approach. Examination was begun in axial plane. The seminal vesicles are seen in cephalad portion of prostate above the prostatic base. The whole prostate was examined in transverse plane from its base to apex by angling the handle of the probe from anterior to posterior using anal sphincter as fulcrum. Angling the handle towards scrotum produces more cephalic image and angling it towards the sacrum produced more caudad images. By rotating the probe in sagittal plane gland is systematically surveyed from right to midline to left.

- Patients presenting with abnormal DRE and/or raised serum PSA level undergone prostatic biopsy under digital guidance. Patients presenting with clinical picture of prostatitis and/or abscess were further evaluated by EPS or needle aspiration as applicable and culture of the sample obtained.
- Collection of reports of examinations and matching them with sonographic findings was done.
- Findings were corroborated and analyzed to reach at a conclusion.

**Results**

Altogether 70 patients were evaluated prospectively in the present study. The study consists of two groups of patients. The first group comprised of 50 patients presenting with symptoms related to bladder outlet obstruction in the Urology OPD. The second group comprised of 20 patients who were suspected of having genital tract (prostate & seminal vesicles) inflammatory or infective conditions. However there were many overlapping features among patients of each group.

The first group of patients (n = 50) were evaluated clinically with digital rectal examination, serum PSA estimation (50/50). Transrectal ultrasound was performed in all cases and then biopsy under digital guidance was performed. Histopathological examination showed 4 cases having benign hypertrophy of prostate and 46 patients having carcinoma of prostate. So in the final analysis the 46 patients were evaluated because transrectal ultrasound was intended to be performed in suspected prostatic malignancy either in DRE and/or serum PSA level.

**Table - 1a Age distribution of patients**

| Age group (years) | Number of cases | Percentage |
|-------------------|-----------------|------------|
| < 45              | 0               | 0          |
| 46 – 50           | 1               | 2.17       |
| 51 – 55           | 3               | 6.52       |
| 56 – 60           | 6               | 13.04      |
| 61 – 65           | 20              | 43.47      |
| 66 – 70           | 11              | 23.91      |
| 71 – 75           | 4               | 8.69       |
| > 76              | 1               | 2.17       |
| Total             | 46              | 100        |

Table 1a reveals that most of the cases belong to the age group 61 – 65 years and 66 – 70 years accounting for 43.47% and 23.91% respectively. The youngest patient in the series was 45 years old and the oldest was 76 years

**Table - 1b Incidence of presenting symptoms**

| Symptoms | Number of patients | Percentage |
|----------|--------------------|------------|
|----------|--------------------|------------|

|                             |    |       |
|-----------------------------|----|-------|
| Dysuria                     | 35 | 76.08 |
| Difficulty in voiding       | 24 | 52.17 |
| Increased urinary frequency | 16 | 34.78 |
| Retention of urine          | 6  | 13.04 |
| Low back pain               | 2  | 4.34  |
| Hematuria                   | 1  | 2.17  |

Dysuria was the most prevalent symptom of prostatic diseases (found in 77.78% cases). Difficulty in voiding and increased urinary frequency were among other common presenting symptoms.

**Table - 1c Findings of digital rectal examination**

| DRE findings                                     | Number of cases | Percentage |
|--------------------------------------------------|-----------------|------------|
| Suspicious with definite nodules                 | 35              | 76.09%     |
| No definite nodule with firm to hard consistency | 7               | 15.28%     |
| Inconclusive                                     | 4               | 8.70%      |

Digital rectal examination is a highly sensitive screening test for prostatic examination. Cases where consistency of prostate was hard with definite palpable nodule and/or obliteration of median groove were considered as positive cases, which were noted in 76.09% cases. Cases where consistency was firm without any definite palpable nodule were considered as negative cases. Cases where consistency was hard but no definite nodule was palpable were considered inconclusive.

**Table - 1d PSA findings**

| Serum PSA level | Number of cases | Percentage |
|-----------------|-----------------|------------|
| < 4 ng/ml       | 2               | 4.35%      |
| 4 – 10 ng/ml    | 3               | 6.52%      |
| > 10 ng/ml      | 41              | 89.13%     |

Serum PSA level more than 10 ng/ml is suggestive of prostatic carcinoma which was seen in 41 cases (89.13% cases). But serum PSA level less than 4 ng/ml was seen only in 5 patients (10.87% cases).

**Table - 1e Role of TRUS in detection of prostatic carcinoma**

| TRUS findings                                      | Number of cases | Percentage |
|----------------------------------------------------|-----------------|------------|
| Suspicious lesion with direct & indirect evidences | 43              | 93.48%     |
| No definite lesion                                 | 2               | 4.35%      |
| Inconclusive                                       | 1               | 2.15%      |

Transrectal ultrasound is highly sensitive method for detection of prostatic carcinoma. Cases where there were hypoechoic areas in prostate or evidences of capsular or extraprostatic extension, were considered as TRUS positive cases (93.48%). Inconclusive in 1 case and no definite lesion was detected in 2 cases.

**Table - 1f Echotexture of prostatic carcinoma by TRUS**

| Echotexture   | Number of cases | Percentage |
|---------------|-----------------|------------|
| Hypoechoic    | 29              | 63.04%     |
| Isoechoic     | 2               | 4.43%      |
| Hyperechoic   | 4               | 8.69%      |
| Heterogeneous | 11              | 23.29%     |

Hyperechoic lesions which are most commonly seen in prostatic carcinoma were seen in 29 cases (63.04%). No definite lesion was seen and mixed echopattern was seen in 11 cases (23%). Isoechoic and hyperechoic lesions were seen in 2 and 4 cases respectively.

**Table - 1g Zonal distribution of prostatic carcinoma by TRUS**

| Zone                 | Number of cases | Percentage |
|----------------------|-----------------|------------|
| Outer gland          | 26              | 56.52      |
| Peripheral zone      | 25              | 54.35      |
| Central zone         | 1               | 2.17       |
| Inner gland          | 6               | 13.04      |
| Transitional zone    | 3               | 6.52       |
| Anterior stroma      | 1               | 2.17       |
| Periurethral zone    | 2               | 4.35       |
| No definite location | 14              | 30.43      |

Prostatic carcinoma was most commonly seen outer part the gland. In the peripheral zone most of the detected lesions were distributed (54.35%). No definite location was possible in 14 cases (30.43%). 13.04% lesions were detected in inner gland.

**Table 1h Patterns of spread of prostatic carcinoma**

| Area involvement  | Number of patients | Percentage |
|-------------------|--------------------|------------|
| Posterior capsule | 37                 | 80.43      |
| Seminal vesicles  | 10                 | 21.73      |
| Bladder trigone   | 12                 | 26.09      |
| Anterior capsule  | 2                  | 4.34       |

Prostatic capsular involvement is common mode of spread in prostatic carcinoma, more commonly it is seen in lower part of because it is a weak zone of prostate. In the present study it was seen in 80.43% cases. Bladder trigone and seminal vesicles are also less commonly affected.

**Table – 1j TRUS findings in Benign patients**

| TRUS findings                             | Number of cases | Percentage |
|-------------------------------------------|-----------------|------------|
| Prostatic abscess                         | 4               | 21         |
| Heterogeneous echopattern (not confirmed) | 1               | 5          |
| Chronic prostatitis                       | 6               | 31.5       |
| Acute prostatitis                         | 1               | 5          |
| Calcific lesions                          | 2               | 10.5       |
| Prostatic cysts                           | 1               | 5          |
| Normal                                    | 4               | 21         |

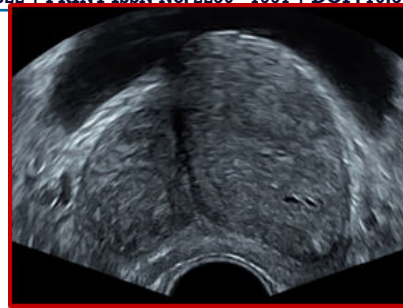
**CASE 1:- BENIGN PROSTATIC HYPERPLASIA**



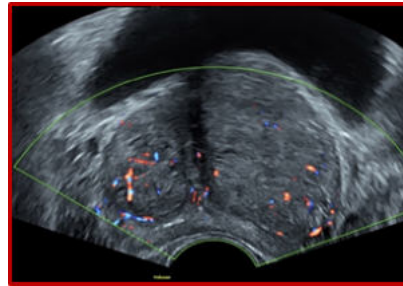
**Fig 1 a:** Transabdominal ultrasound showing enlarged transitional zone



**Fig 1b:** same case as above on Colour Doppler study



**Fig 1c:** Transrectal ultrasound of same patient demonstrating uniform enlargement of transitional zone

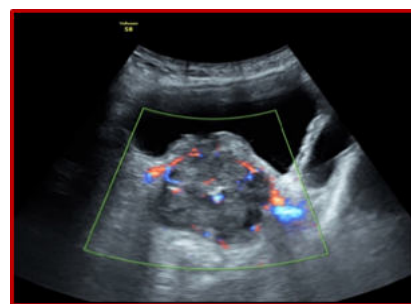


**Fig 1d :** Same case as above with TRUS on Colour Doppler study

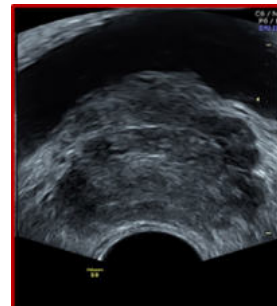
**CASE 2:- PROSTATIC CARCINOMA**



**Fig2 a:** Transabdominal ultrasound showing heterogenous and irregular predominantly hypoechoic mass lesion in peripheral zone of prostate

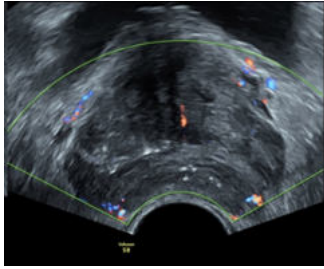


**Fig 2b :** Same case as above on Colour Doppler study showing increased central vascularity





**Fig 2c : same patient subjected to TRUS showing heterogenous predominantly hypoechoic lesion in peripheral zone**



**Fig 2d : Colour Doppler study on TRUS showing increased central vascularity in lesion**  
**Discussion**

In the prostatic carcinoma group the maximum number of patients with prostatic carcinoma was in 61 – 65 years age group, the second most common group was 66 – 70 years. 67.48% patients belong to 6<sup>th</sup> decade of life. This data correlates well with the age of presentation of prostatic carcinoma as it increases with age. Less number of cases were available in 7<sup>th</sup> or 8<sup>th</sup> decades of life may be due to less life expectancy. Early prostatic carcinoma is mostly asymptomatic. Advanced stages are mostly asymptomatic. Advanced stages are usually symptomatic but may be asymptomatic. Presenting complaints in the present study (in descending order) included dysuria, difficulty in voiding, increased frequency, urinary retention, back pain and hematuria. In Campbell's Urology the same order of symptoms have been mentioned. Dysuria is the most common symptom, seen in 76.08% patients.<sup>5</sup>

In the present study DRE was suggestive of prostatic carcinoma in 35 patients (76.08%). It was inconclusive for another 4 cases (8.70%) and in 7 cases it was not suggestive of the disease. In 1984, Chodak and Schoenberg claimed that digital rectal examination was the most sensitive method for diagnosis<sup>(6)</sup> In 1997 Sibley RI and Sibley AF of Hampton, Virginia USA reported 60% sensitivity of DRE.

**Serum PSA level vs. prostatic carcinoma:** In this study group, serum PSA level more than 10 ng/ml, which is considered highly suggestive of prostatic carcinoma, was noted in 89.13% cases. PSA level below 10ng/ml was seen in 10.87% cases. In 1993 Crawford ED, De Antoni EP reported PSA lacks sufficient specificity and sensitivity to be used as a screening test for prostatic cancer. However in conjunction with digital rectal examination and transrectal ultrasound PSA can greatly improve detection rate. In 1997 Sibley RI, Sibley AF reported the sensitivity of serum PSA level was 94%.<sup>3</sup>

**Transrectal ultrasound in prostatic carcinoma as a screening modality:**

In the present study transrectal ultrasonography was suggestive of prostatic carcinoma in 93.48% cases. It was inconclusive in 1 case and no definite lesion was detectable in 2 cases (4.35%). In 1991, Lee F, McHugh TA et al reported TRUS as 92% sensitive. In 1997, Sibley RI, Sibley AF reported TRUS as 78% sensitive.<sup>4</sup>

**Transrectal ultrasonography – Echotexture of prostatic carcinoma:**

In the present study the principal or index cancer was hypoechoic in 63.04% cases.

The tumour was not clearly visible (isoechoic) but suspicious with other evidences in 2 cases (4.34%). Tumour was hyperechoic in 4 cases (8.69%) and heterogeneous prostatic echotexture was noted in 11 cases (23.91%). Riffkin et al reported in 1989 the predominant hypoechoic appearance of

prostatic carcinoma.<sup>5,6</sup>

**Transrectal ultrasound – zonal distribution:** In the present study 26 out of 46 cases were distributed in outer gland of which 54.35% was distributed in peripheral zone. 6.52% cases were located in transition zone. No definite localization was possible in 30.43% cases. Byar and Mostafi reported 75% of carcinoma located in peripheral zone near the apex. 5 – 10% of cancer situated in central zone and 10 – 20% originates in inner gland.<sup>7</sup>

**The genital tract infection group:** In this study most of the patients were in the age group 41 – 45 years. The average age was 43.8 years. TRUS examination was performed in patients with signs indicative of infection. Rectal examination showed tenderness and enlargement of prostate in some cases, urine examination was positive in most cases.

Prostatic abscess was found in 4 cases. There were prominent symptoms with perineal pain, dysuria and bladder outlet obstruction. Enlargement of prostate was found in 75% cases. Aspiration was done in all cases. Positive bacteriological finding was there in all cases. One patient had diabetes which suggests that patients with diabetes are prone to prostatic abscess.

Mears in 1986 and Weinberger in 1988 have shown the importance of transrectal ultrasound in diagnosis and aspiration of prostatic abscess. They have also shown that patients with diabetes, chronic renal failure and other immunocompromised conditions are more prone to develop prostatic abscess. Chronic bacterial prostatitis: After doing TRUS in all 6 patients were evaluated and confirmed by EPS study. Heterogeneous echopattern was seen in 67% cases, capsular irregularity in 50%, peripheral zone irregularity in 22%, calcifications in 50%. Studies of Weigand and Weinder have shown presence of heterogeneous echo in 62.9% cases. Other findings included midrange echo, capsular thickening and irregularity and peripheral zone irregularity. However none of these are diagnostic. Most commonly a combination of these is found.<sup>8,9</sup>

**Conclusion**

Transrectal ultrasound is also very helpful for identifying infective conditions of prostate gland when initially screened by positive urine test. This has been further proved by definitive further studies like EPS and aspiration.<sup>10</sup>

There are many advantages of transrectal ultrasonography that warrants its wider use in assessment of prostatic pathologies – especially as the first line imaging modality. It is much cheaper and easily available, real-time imaging, portable and mobile. It has multiplanar imaging capability and detailed assessment of zonal anatomy of prostate can be performed. Colour and power Doppler can be used simultaneously to assess the vascularity of a lesion. In conjunction with digital rectal examination and serum PSA level, transrectal ultrasonography is very useful for prostatic carcinoma management. Transrectal ultrasound is helpful for staging of prostatic carcinoma and for guided biopsy.

**References**

- Gayet M, van der Aa A, Schmitz P, Beerlage HP, Schrier BP, Mulders PF, Mischi M, Wijkstra H. 3D Navigo™ versus TRUS-guided prostate biopsy in prostate cancer detection. *World J Urol.* 2016 Sep;34(9):1255-60. doi: 10.1007/s00345-016-1775-9. Epub 2016 Feb 4. PMID: 26847183
- Chodak GW, Schoenberg HW: Early detection of prostate cancer by routine screening. *JAMA* 1984;252:3261-3264.
- Sibley RI; Sibley AF: correlation of digital rectal examination. Prostate specific antigen and transrectal ultrasound in prostate carcinoma in African American. *J. Natl. Medical Assoc.* 89(5): 318-323 1997.
- Forman HP, Heiken JP, Brink JA et al: CT Scanning for comorbid disease in patients with prostatic carcinoma: is it cost effective? *American Journal of Radiology.* 162:1125-1128, 1994.
- Crawford ED, De Antoni EP: PSA as a screening test for prostate cancer: *Urology clinics of North America* 20(4): 637-646, 1993.
- Weinberger M, Cytron S, Seeradio C et al: Prostatic abscess in the antibiotic era. *Rev. Infect. Disease* 1988; 10: 239.

7. Selem M, Desoky A, Eliwa A, Fawzi A, Elkady E, Ali MM, Ragab A, Sakr A—Transrectal ultrasound- guided aspiration versus transurethral deroofting of prostatic abscess: a prospective randomised study. *Urol Ann.* 2018 jul- sept; 10(3):291-295. Doi:10.4103/UA.UA-41-17.
8. Cao NL, Lu QJ, Wang XH, Ni JS, GuBJ—Correlation between prostatic parameters of transrectal ultrasonography and age in patients with benign prostatic hyperplasia. *Zhonghua Nan Ke Xue.* 2017 Apr; 23(4):315-318.
9. Mears, EM: Prostatic abscess. *Journal Urology* 1986; 136:1281.
10. Steinkohl F, Leuger AK, Pichler R, Bektic J, Rehder P, Lebowici A—Visibility of MRI prostate lesions on B-mode transrectal ultrasound. *Med Ultrasound .* 2018 Dec 8; 20(4):441-445. Doi: 10.11152/mu-1602.