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Original Research Article

Ultrasonography of Prostate- An Observational Study

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Abstract: Prostate is of great clinical importance and ultrasonography is an ideal diagnostic aid. High frequency transrectal ultrasonography (TRUS) provides a remarkably detailed view of the prostate. This study is aimed at demonstrating the ultrasonographic changes in the human prostate disorders during successive physiological changes of growth. This was an observational study done in Regional cancer center (RCC), Trivandrum. Ultrasonographic anatomy of human prostate was done at RCC, Trivandrum. Sonogram of 40 cases in different decades of growth was observed. Internal Anatomy and sonographic changes of the images were studied. The echotextural pattern of the normal prostate, hyperplastic prostate, abscess, cyst and carcinoma prostate are described and discussed. Transition zone is enlarged in hyperplasia and carcinoma cast hypoechoic shadows in peripheral zone. Volume of the prostate increases with increase in age.
Keywords: Prostate; Hyperplasia; TRUS, carcinoma, transition zone, peripheral zone, sonogram, prostate volume

INTRODUCTION

Prostate is the largest accessory sex organ in male. In clinical situations prostate disorders such as hyperplasia, prostatitis, tumours are major commitments for clinicians. Regional Anatomy of prostate has been debated periodically; first with the concept of lobes and then by the current pathologic zonal architecture which consists of anterior fibromuscular stroma devoid of glandular tissue, transition zone(tz),central zone(cz) and peripheral zone(pz). But these regions are not visible sonographically as distinct entities. Imaging helps to visualize prostate as it lies between the bladder neck and urogenital diaphragm just anterior to the rectum. This is an ideal position to be imaged by TRUS. TRUS has become a widely utilized procedure since its popularization by Watanabe and associates in 1971 [1]. Its application has grown rapidly over the last few years.

MATERIALS AND METHODS

This study was done in the Dept. of Radiodiagnosis, RCC, Trivandrum Ultrasound images of 40 cases of 21-80years of age were studied except 1st decade because of less frequency of procedure in that age group. Sonograms were made in both the transverse (axial) and longitudinal (sagittal) planes. Endorectal probes transmitting frequencies of 6-10MHz are used. The coupling medium-sonographic jelly is placed between the probe and rectal surface. TRUS evaluation includes scanning in both sagittal and transverse planes and different zones were inspected for lesions. Optimal brightness setting results in medium –gray image of the normal peripheral zone (pz) which serves as a reference point for judging lesions as hypoechoic (darker than normal pz), isoechoic (similar to pz), hyperechoic (lighter than pz) or anechoic(completely black). Sonometrics which is a combination of TRUS and biometrics is a simple method to determine weight and volume. Diameters of the gland are measured with the optomanual image analysis system using computer. The transverse, anteroposterior and vertical diameters were measured and the volume of prostate was calculated and tabulated.

OBSERVATION

Observations were made on the basis of ultrasonogram of prostate in various age groups. Average volume for each decade was calculated from the three diameters (Table.1) and was found that the mean volume increases significantly in relation to increased age of the individual. In the present study a

relative decrease in volume is noted in the 7th decade (Figure.1).

Sonogram of normal prostate (Figure.2) has a semilunar shape in the transverse view. Prostatic urethra is collapsed and the fibromuscular periurethral tissue is seen as hypoechoic area in the anterior prostate. Transition zone (tz) is seen as small areas of mixed echo genecity on both sides of urethra. The pz has a finely stippled echo pattern. Tz is separated from the central and peripheral zone by a layer of fibrous tissue which is visible as surgical capsule in sonogram. Rectal wall is seen as multilayered structure. In chronic prostatitis sonogram (Figure.3) shows patchy echoic areas scattered throughout the gland. These areas represent inflammation. Multiple hyper echoic areas seen in the periurethral region are suggestive of calcification. Figure 4 is of prostate abscess which shows periurethral hypoechoic area and is surrounded by areas of normal echogenecity.

In transverse view of benign prostatic hyperplasia (Figure.5) prostate assumes a globular shape. There is extensive enlargement of tz which is fine homogenous and slightly hypoechoic and compression of peripheral zone is noticed. The 3 diameters are increased. Bright echogenic calcification is seen to lie in the surgical capsule. In the longitudinal or sagittal view the enlarged transition zone is projecting into the bladder (Figure.6). Both views of hyperplasia of prostate (Figure.7) present diffuse enlargement of prostate which assumes a rounded contour and all diameters are increased.

Sonogram transverse view (Figure. 8) shows a smooth walled prostatic cyst measuring 1.4x1.6x1.5cm; it appears anechoic, uniformly dark, free of internal echoes and is clearly demarcated from the surrounding tissue.

Sonogram - both transeverse and sagittal view of carcinoma prostate shows a hypoechoic lesion in the right peripheral zone and the boundary echo is deformed.(Figure.9)

Table-1: Prostate in various age groups

AGE(in years)	AVERAGE DIAMETERS MEASURED BY TRUS(cms)			AVERAGE VOLUME(cc)
	Transverse	Vertical	Anterio-Posterior	
21 – 30	4	2.8	2.6	29.1
31 – 40	4.4	3.2	2.8	39.4
41 – 50	4.6	3.6	3.2	52.9
51 – 60	4.8	3.8	3.6	65.6
61 – 70	5.4	4.2	3.6	81.6
71 – 80	5.2	4.2	3.6	78.6

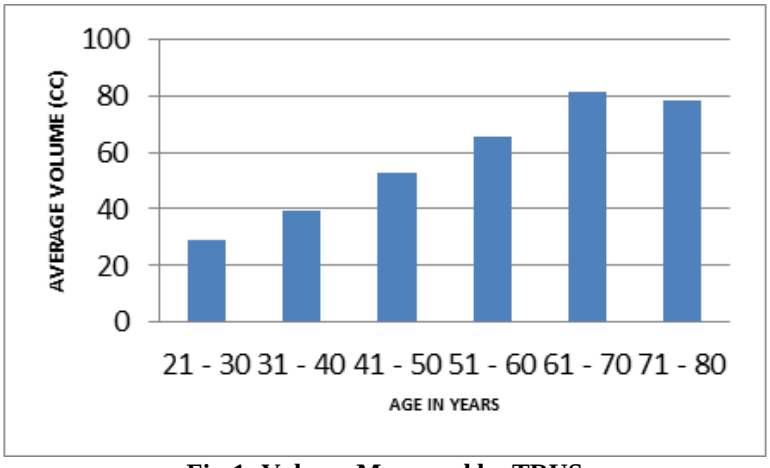

Fig-1: Volume Measured by TRUS

Fig-2: Sonogram of normal prostate.

Fig-3: Transverse view of prostatitis with calcification and patchy hypoechoic areas.

Fig-4: Transverse view of abscess with periurethral hypoechoic area

Fig-5: Transverse view of benign prostatic hyperplasia with extensive enlargement of TZ

Fig-6: Sagittal view of prostatic hyperplasia with enlarged TZ projecting into the bladder.

Fig-7: Hyperplasia of prostate – all diameters increased.

Fig-8: Transverse view showing smooth walled prostatic cyst.

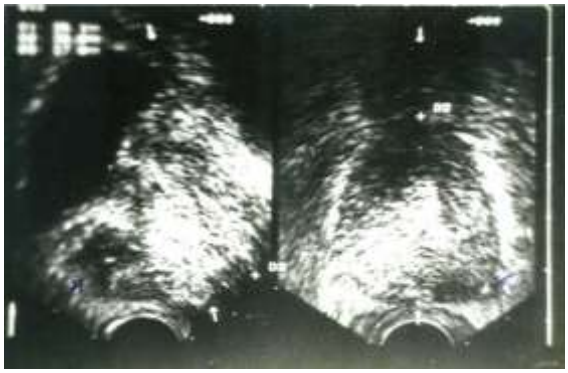

Fig-9: Transverse and sagittal view of carcinoma prostate

DISCUSSION

The purpose of the undertaken study was to demonstrate the ultrasonographic changes in the human prostate disorders during successive physiological changes of growth.

The zonal anatomy of prostate can be appreciated on transverse sectioning. The transition zone may be minimal and is seen as small areas of mixed echogenecity on both sides of the urethra. The peripheral and central zones are homogenous and moderately echogenic surrounding the transition zone and is separated from it by a surgical capsule [2]. Findings of present study agreed with that of Shinohara *et al*. [3] who described a finely stippled echo pattern for PZ which is created by the reflections of the propogated wave from the interfaces between stroma and acini. Watanabe H *et al*. [1] stated that volume of prostate can be determined more accurately by ultrasonography than by palpation.

According to Ingram S *et al*. [4] monitoring of prostatic volume is important in hypogonadal males. In the present study it was found that the mean volume increases significantly in relation to increased age of the individual.

According to Kumasaka [5], a hypoechoic area can be generated by a number of conditions like cysts, abscess, dilated ducts, blood vessels etc. Fluid filled structures such as prostatic cysts are smooth walled and are free of internal echoes. This appears uniformly dark [6], in the present study also sonographic picture of cysts showed anechoic appearance.

Calcification within the prostate are frequently detected with ultrasonography, usually calculi are associated with benign prostatic hyperplasia (BPH), this tend to lie along the surgical capsule which highlight the plane between pz and cz. [7]. Echo textural pattern of BPH suggested by McNeal [8] was same as that of present findings. There is diffuse enlargement of prostate which assume a rounded contour.

Terris *et al*. [9] described the echo texture of prostatitis as patchy area of decrease echogenicity thought to be caused by edema and the resulting decrease in the number of reflecting surfaces within the tissue. This was also noted in the present study.

Typical ultrasonographic appearance of prostate cancer has been surprisingly controversial issue. Most ultrasonographers now recognized that cancer usually appears hypoechoic relative to the normal echo pattern of the peripheral zone [10]. In the present study carcinoma appeared as a hypoechoic area within the peripheral glandular zone.

CONCLUSION

Forty patients were examined with trans rectal ultrasonography. Average volume was measured and it was found that the volume increases with increasing age. This study demonstrates the ultrasonographic changes in the human prostate disorders during successive physiological changes of growth. The ecotextural pattern of the normal prostate, hyperplastic prostate, carcinoma prostate, cyst and abscess are described and discussed.

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