

Penis and Prostate

1) Other Names

- None

2) Definition/ Location

- The prostate is a doughnut-like gland that lies inferior to the urinary bladder surrounding the proximal urethra (Curry-Tempkin p.237 C1/P1/S1).
- The prostate lies behind the symphysis pubis and is separated posteriorly from the rectum by the two layers of Denonvillier's fascia (Curry-Tempkin p.237 C1/P1/S2).
- Laterally, the prostate is supported by the obturator internus and levator ani muscles (Curry-Tempkin p.237 C1P/1/S3).
- The prostate is perforated by the two ejaculatory ducts, which enter the prostate at its posterior margin and course obliquely and anteriorly to join the prostatic urethra near the verumontanum, an area close to the center of the prostate (Curry-Tempkin p.240 C1/P1/S3).
- The prostate is divided into four zones: the central zone, transition zone, peripheral zone, and periurethral glandular zone (Curry-Tempkin p.240 C1/P2/S).
- The peripheral zone is the largest, making up approximately 70% and occupying the area lateral and posterior to the distal prostatic urethra (Curry-Tempkin p.240 C1/P3/S1-2).
- The central zone forms about 20% and is located at the superior edge bordering the bladder and seminal vesicles (Curry-Tempkin p.240 C1/P3/S3).
- The transition zone comprises about 5% and has two lobes on either side of the proximal prostatic urethra (Curry-Tempkin p.240 C2/P1/S1).
- The tissue that lines the proximal prostatic urethra forms the periurethral glandular zone (Curry-Tempkin p.240 C2/P1/S3).
- The prostate produces and secretes an alkaline fluid. Its secretions constitute between 13% and 33% of the volume of semen. This alkaline fluid is believed to neutralize the acidic environment of the vagina, uterus, and fallopian tubes, where fertilization of the ovum takes place (Curry-Tempkin p.242 C1/P6/S1-3).
- The penis is composed of three cylindrical masses of tissue. There are two corpora cavernosa situated dorsally and a single corpus spongiosum in the mid ventral region, which contains the spongy urethra (Curry-Tempkin p.240 C2/P2/S1-2).
- The two corpora cavernosa are the main erectile structures of the penis. Both the corpora cavernosa and the corpus spongiosum are enveloped in the tunica albuginea (Rumack p.823 C2/P3/S1).
- The reproductive function of the penis is to eject semen into the vagina (Curry-Tempkin p.242 C2/P1/S1).
- The blood supply to the penis and urethra is via the paired internal pudendal arteries, which are branches of the internal iliac arteries (Curry-Tempkin p.242 C1/P2/S1).

3) Ultrasound Appearance: (Tempkin, p.267, “Sonographic Appearance”)

- The majority of the parenchyma of the prostate gland appears as homogenous, midgray, medium low-level echoes.
- The periurethral glandular stroma that surrounds the urethra is slightly hypoechoic compared with surrounding tissue.
- The contour of the gland should appear smooth and the margins well defined. Calcifications may be seen throughout the gland in older patients.
- The normal prostate should appear symmetrical.
- The seminal vesicles appear as symmetrical mid-gray or medium to low level echo textures, superior to the prostate. They are easier to visualize when the urinary bladder is partially filled.
- The prostatic urethra walls appear echogenic at the midline of the gland.
- The vas deferens and ejaculatory ducts may be difficult to distinguish from surrounding structures. However, when seen, the vas deferens are medial to, and have an echo texture similar to the seminal vesicles. The ejaculatory ducts will appear as echogenic double lines.
- Normally, the central and transition zones are not sonographically distinctive. The peripheral zone appears homogenous and slightly hyperechoic to adjacent parenchyma.
- In the transverse plane, the corpus spongiosum will be seen in the midline and will appear elliptical in shape. The corpus spongiosum should be of homogenous texture composed of medium-level echoes. The two corpora cavernosa are covered by the highly echogenic tunica albuginea (Curry-Tempkin p.243 C2/P3/S1-4).
- In the longitudinal plane, each corpora cavernosum should remain homogenous with highly echogenic tunica albuginea visualized above and below. The cavernosal arteries will be imaged in their long axis and appear as parallel echogenic lines coursing through the middle of the corpora cavernosa (Curry-Tempkin p.245 C2/P1/S1-2).

4) Normal Size Range: (Curry-Tempkin, p. 246, “Normal Measurements”)

- Prostate-
 - 4 cm transverse
 - 3 cm anteroposterior
 - 3.8 in length
 - approximately 20 grams in weight

5) Pertinent Lab Data: (Curry-Tempkin, p. 246, “Laboratory Values”)

- Serum Prostatic Specific Antigen (PSA): Used to evaluate the function of the prostate. Normal serum PSA is less than 4.0. Elevated serum PSA may indicate disease but is not specific for carcinoma.

6) Common Pathologies:

- To be included in Mrs. Campbell’s lectures.

7) Patient Prep: (Tempkin, p. 267, “Patient Prep”)

- Self-administered enema prior to the exam. If for some reason the patient cannot have the enema, still attempt the exam.
- Explain the examination to the patient. Verbal or written consent is required and the exam should be witnessed by another health care professional. The initials of the witness should be part of the film labeling.
- The transducer may be inserted by the sonographer or physician.

8) Transducer (Probe) Frequency: (Tempkin, p. 268, “Transducer”)

- 5 to 10 MHz
- Preparing the transducer includes providing a water path.
Preparation options include:
 - A) Some transducer manufacturers provide a finger-like sheath that slides onto the transducer head. The sheath is secured by a small rubber band, and 20 or 30 ml of nonionized water is injected into the sheath through a pathway inside the transducer handle. Tip the transducer down and tap the water-filled sheath so any air bubbles rise to the top and can be aspirated. Fill a condom half full with sonographic gel, then put the sheathed transducer in it. Apply additional lubrication to the outside of the condom before insertion. A small rubber hose can be attached to the transducer pathway to introduce or aspirate water from the sheath to adjust for any air bubbles that might occur and cause artifacts.
 - B) Apply gel to the end of the transducer, then cover it with a condom. Secure the condom with a rubber band and make sure there are no air bubbles at the tip. Apply additional lubrication to the outside of the condom before insertion. Use an inner balloon filled with 30 to 50 ml of nonionized water as a water path.
 - C) Cover a transducer with a condom and secure it with a rubber band. Lubricate the outside of the condom, and then insert the transducer into the rectum. Fill the condom with 30 to 50 ml of nonionized water for a water path.

9) Protocol: (Tempkin, p. 269, “Prostate Survey”; Tempkin, p. 270, “Required Images”)

- Transverse Survey:
 - With the transducer inserted, the survey begins at the level of the seminal vesicles.
 - After the seminal vesicles and vas deferens have been evaluated, slowly withdraw the transducer to scan through the prostate from its superior to inferior margins. The later margins should be well defined.
 - Note the size, shape, and symmetry of the prostate
- Longitudinal Survey:
 - Begin at the midline of the prostate. The superior and inferior margins should be well defined and the prostatic urethra visualized.
 - To examine the lateral aspects of the prostate, seminal vesicles, and vas deferens, rotate the transducer clockwise and counterclockwise.
- Transverse Images: (Rectal Approach)
 - Transverse image of the seminal vesicles.
 - Transverse image of the right seminal vesicle to include its right lateral margin.
 - Transverse mage of the left seminal vesicle to include its left lateral margin.
 - Transverse image of the base of the prostate.
 - Transverse image of the mid prostate/
 - Transverse image of the apex of the prostate.
- Longitudinal Images: (Rectal Approach)
 - Longitudinal midline image of the prostate.
 - Longitudinal image of the right lateral portion of the prostate gland and seminal vesicle.
 - Longitudinal image of the left lateral portion of the prostate gland and seminal vesicles.

10) Image References:

- Curry- Tempkin, p. 240, Fig. 15-4
- Curry-Tempkin, p. 241, Fig. 15-5
- Curry-Tempkin, p. 244, Fig. 15-9
- Curry-Tempkin, p. 245, Fig. 15-11
- Hagen-Ansert, Volume 1, p. 452, Fig. 15-41
- Tempkin, p. 269, “Transverse Survey”
- Tempkin, p. 269, “Longitudinal Survey”
- Tempkin, p. 270, Image 1
- Tempkin, p. 270, Image 2
- Tempkin, p. 271, Image 3
- Tempkin, p. 271, Image 4
- Tempkin, p. 272, Image 5
- Tempkin, p. 272, Image 6
- Tempkin, p. 273, Image 7
- Tempkin, p. 273, Image 8
- Tempkin, p. 274, Image 9

11) References:

- Curry, R.A. and Tempkin, B.B. (2004). Sonography: Introduction to Normal Structures and Functions (2nd ed.). St. Louis, MO: Saunders.
- Hagen-Ansert, S.L. (2006). Textbook of Diagnostic Ultrasonography (6th ed.)(Vol. 1). St. Louis, MO: Mosby.
- Rumack, C. (1998). Diagnostic Ultrasound (2nd ed.)(Vol.1). St. Louis, MO: Mosby.
- Tempkin, B.B. (1999). Ultrasound Scanning: Principles and Protocols (2nd ed.). Philadelphia, PA: Saunders.