Radiographic Anatomy

For a detailed discussion, see page 226.

Surface Anatomy

Surface Landmarks of the Abdominal Wall

Xiphoid Process

The xiphoid process is the thin cartilaginous lower part of the sternum. It is easily palpated in the depression where the costal margins meet in the upper part of the anterior abdominal wall (see Figs. 4.11 and 4.12). The **xiphisternal junction** is identified by feeling the lower edge of the body of the sternum, and it lies opposite the body of the ninth thoracic vertebra.

Costal Margin

The costal margin is the curved lower margin of the thoracic wall and is formed in front by the cartilages of the 7th, 8th, 9th, and 10th ribs (see Figs. 4.11 and 4.12) and behind by the cartilages of the 11th and 12th ribs. The costal margin reaches its lowest level at the 10th costal cartilage, which lies opposite the body of the 3rd lumbar vertebra. The 12th rib may be short and difficult to palpate.

Iliac Crest

The iliac crest can be felt along its entire length and ends in front at the **anterior superior iliac spine** (see Figs. 4.11 and 4.12) and behind at the **posterior superior iliac spine** (Fig. 4.49). Its highest point lies opposite the body of the 4th lumbar vertebra.

About 2 in. (5 cm) posterior to the anterior superior iliac spine, the outer margin projects to form the tubercle of the crest (see Fig. 4.12). The tubercle lies at the level of the body of the 5th lumbar vertebra.

Pubic Tubercle

The pubic tubercle is an important surface landmark. It may be identified as a small protuberance along the superior surface of the pubis (see Figs. 4.3, 4.12, and 4.32).

Symphysis Pubis

The symphysis pubis is the cartilaginous joint that lies in the midline between the bodies of the pubic bones (see Fig. 4.11). It is felt as a solid structure beneath the skin in the midline at the lower extremity of the anterior abdominal wall. The **pubic crest** is the name given to the ridge on the superior surface of the pubic bones medial to the pubic tubercle (see Fig. 4.32).

Inguinal Ligament

The inguinal ligament lies beneath a skin crease in the groin. It is the rolled-under inferior margin of the aponeurosis of the external oblique muscle (see Figs. 4.2, 4.6, and 4.11). It is attached laterally to the anterior superior iliac spine and curves downward and medially, to be attached to the pubic tubercle.

Superficial Inguinal Ring

The superficial inguinal ring is a triangular aperture in the aponeurosis of the external oblique muscle and is situated above and medial to the pubic tubercle (see Figs. 4.2, 4.3, 4.8, and 4.12). In the adult male, the margins of the ring can be felt by invaginating the skin of the upper part of the scrotum with the tip of the little finger. The soft tubular **spermatic cord** can be felt emerging from the ring and descending over or medial to the pubic tubercle into the scrotum (see Fig. 4.8). Palpate the spermatic cord in the upper part of the scrotum between the finger and thumb and note the presence of a firm cordlike structure in its posterior part called the **vas deferens** (see Figs. 4.5 and 4.21).

In the female, the superficial inguinal ring is smaller and difficult to palpate; it transmits the round ligament of the uterus.

Scrotum

The scrotum is a pouch of skin and fascia containing the testes, the epididymides, and the lower ends of the spermatic cords. The skin of the scrotum is wrinkled and is covered with sparse hairs. The bilateral origin of the scrotum is indicated by the presence of a dark line in the midline, called the **scrotal raphe,** along the line of fusion. The **testis** on each side is a firm ovoid body surrounded on its lateral, anterior, and medial surfaces by the two layers of the **tunica vaginalis** (see Fig. 4.21). The testis should therefore lie free and not tethered to the skin or subcutaneous tissue. Posterior to the testis is an elongated structure, the **epididymis** (see Fig. 4.21). It has an enlarged upper end called the **head,** a **body,** and a narrow lower end, the **tail.** The vas deferens emerges from the tail and ascends medial to the epididymis to enter the spermatic cord at the upper end of the scrotum.

Linea Alba

The linea alba is a vertically running fibrous band that extends from the symphysis pubis to the xiphoid process and lies in the midline (see Fig. 4.3). It is formed by the fusion of the aponeuroses of the muscles of the anterior abdominal wall and is represented on the surface by a slight median groove (see Figs. 4.11 and 4.12).

Umbilicus

The umbilicus lies in the linea alba and is inconstant in position. It is a puckered scar and is the site of attachment of the umbilical cord in the fetus.

Rectus Abdominis

The rectus abdominis muscles lie on either side of the linea alba (see Fig. 4.11) and run vertically in the abdominal wall; they can be made prominent by asking the patient to raise the shoulders while in the supine position without using the arms.

Tendinous Intersections of the Rectus Abdominis

The tendinous intersections are three in number and run across the rectus abdominis muscle. In muscular individuals, they can be palpated as transverse depressions at the level of the tip of the xiphoid process, at the umbilicus, and halfway between the two (see Fig. 4.11).

Linea Semilunaris

The linea semilunaris is the lateral edge of the rectus abdominis muscle and crosses the costal margin at the tip of the ninth costal cartilage (see Figs. 4.11 and 4.12). To accentuate the semilunar lines, the patient is asked to lie on the back and raise the shoulders off the couch without using the arms. To accomplish this, the patient contracts the rectus abdominis muscles so that their lateral edges stand out.

Abdominal Lines and Planes

Vertical lines and horizontal planes (see Fig. 4.12) are commonly used to facilitate the description of the location of diseased structures or the performing of abdominal procedures.

Vertical Lines

Each vertical line (right and left) passes through the midpoint between the anterior superior iliac spine and the symphysis pubis.

Transpyloric Plane

The horizontal transpyloric plane passes through the tips of the ninth costal cartilages on the two sides—that is, the point where the lateral margin of the rectus abdominis (linea semilunaris) crosses the costal margin (see Fig. 4.12). It lies at the level of the body of the 1st lumbar vertebra. This plane passes through the pylorus of the stomach, the duodenojejunal junction, the neck of the pancreas, and the hila of the kidneys.

Subcostal Plane

The horizontal subcostal plane joins the lowest point of the costal margin on each side—that is, the 10th costal cartilage (see Fig. 4.12). This plane lies at the level of the 3rd lumbar vertebra.

Intercristal Plane

The intercristal plane passes across the highest points on the iliac crests and lies on the level of the body of the 4th lumbar vertebra. This is commonly used as a surface landmark when performing a lumbar spinal tap (see page 704).

Intertubercular Plane

The horizontal intertubercular plane joins the tubercles on the iliac crests (see Fig. 4.12) and lies at the level of the 5th lumbar vertebra.

Abdominal Quadrants

It is common practice to divide the abdomen into quadrants by using a vertical and a horizontal line that intersect at the umbilicus (see Fig. 4.12). The quadrants are the upper right, upper left, lower right, and lower left. The terms **epigastrium** and **periumbilical** are loosely used to indicate the area below the xiphoid process and above the umbilicus and the area around the umbilicus, respectively.

Surface Landmarks of the Abdominal Viscera

It must be emphasized that the positions of most of the abdominal viscera show individual variations as well as variations in the same person at different times. Posture and respiration have a profound influence on the position of viscera.

The following organs are more or less fixed, and their surface markings are of clinical value.

Liver

The liver lies under cover of the lower ribs, and most of its bulk lies on the right side (Fig. 4.48). In infants, until about the end of the third year, the lower margin of the liver extends one or two fingerbreadths below the costal margin (see Fig. 4.48). In the adult who is obese or has a well-developed right rectus abdominis muscle, the liver is not palpable. In a thin adult, the lower edge of the liver may be felt a fingerbreadth below the costal margin. It is most easily felt when the patient inspires deeply and the diaphragm contracts and pushes down the liver.

Gallbladder

The fundus of the gallbladder lies opposite the tip of the right ninth costal cartilage—that is, where the lateral edge of the right rectus abdominis muscle crosses the costal margin (see Fig. 4.48).

Spleen

The spleen is situated in the left upper quadrant and lies under cover of the 9th, 10th, and 11th ribs (see Fig. 4.48). Its long axis corresponds to that of the 10th rib, and in the adult it does not normally project forward in front of the midaxillary line. In infants, the lower pole of the spleen may just be felt (see Fig. 4.48).

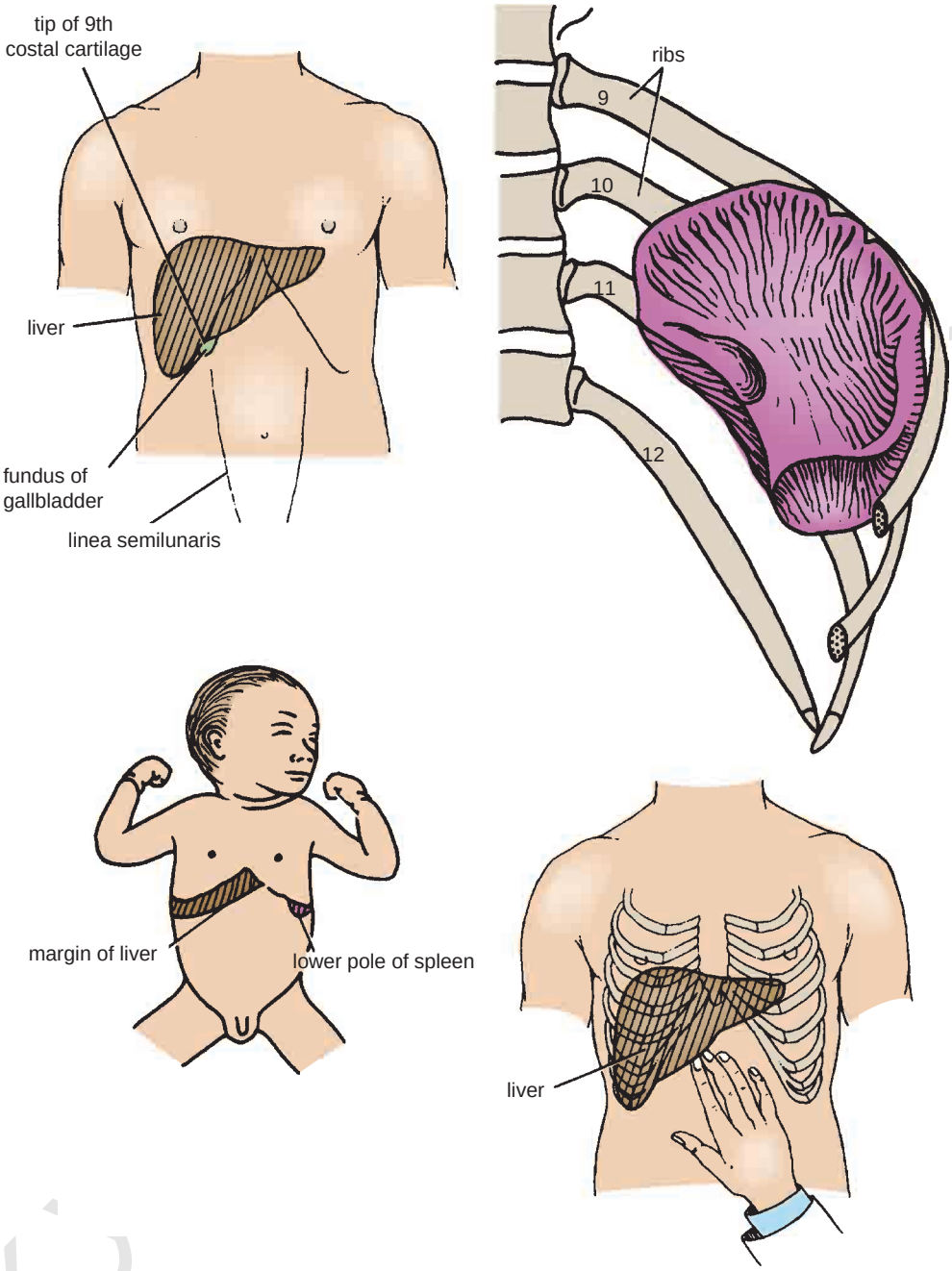

FIGURE 4.48 Surface markings of the fundus of the gallbladder, spleen, and liver. In a young child, the lower margin of the normal liver and the lower pole of the normal spleen can be palpated. In a thin adult, the lower margin of the normal liver may just be felt at the end of deep inspiration.

Pancreas

The pancreas lies across the transpyloric plane. The head lies below and to the right, the neck lies on the plane, and the body and tail lie above and to the left.

Kidneys

The right kidney lies at a slightly lower level than the left kidney (because of the bulk of the right lobe of the liver), and the lower pole can be palpated in the right lumbar region at the end of deep inspiration in a person with poorly developed abdominal muscles. Each kidney moves about 1 in. (2.5 cm) in a vertical direction during full respiratory movement of the diaphragm. The normal left kidney, which is higher than the right kidney, is not palpable.

On the anterior abdominal wall, the hilum of each kidney lies on the transpyloric plane, about three fingerbreadths from the midline (see Fig. 4.49). On the back, the kidneys extend from the 12th thoracic spine to the 3rd lumbar spine, and the hili are opposite the 1st lumbar vertebra (see Fig. 4.49).

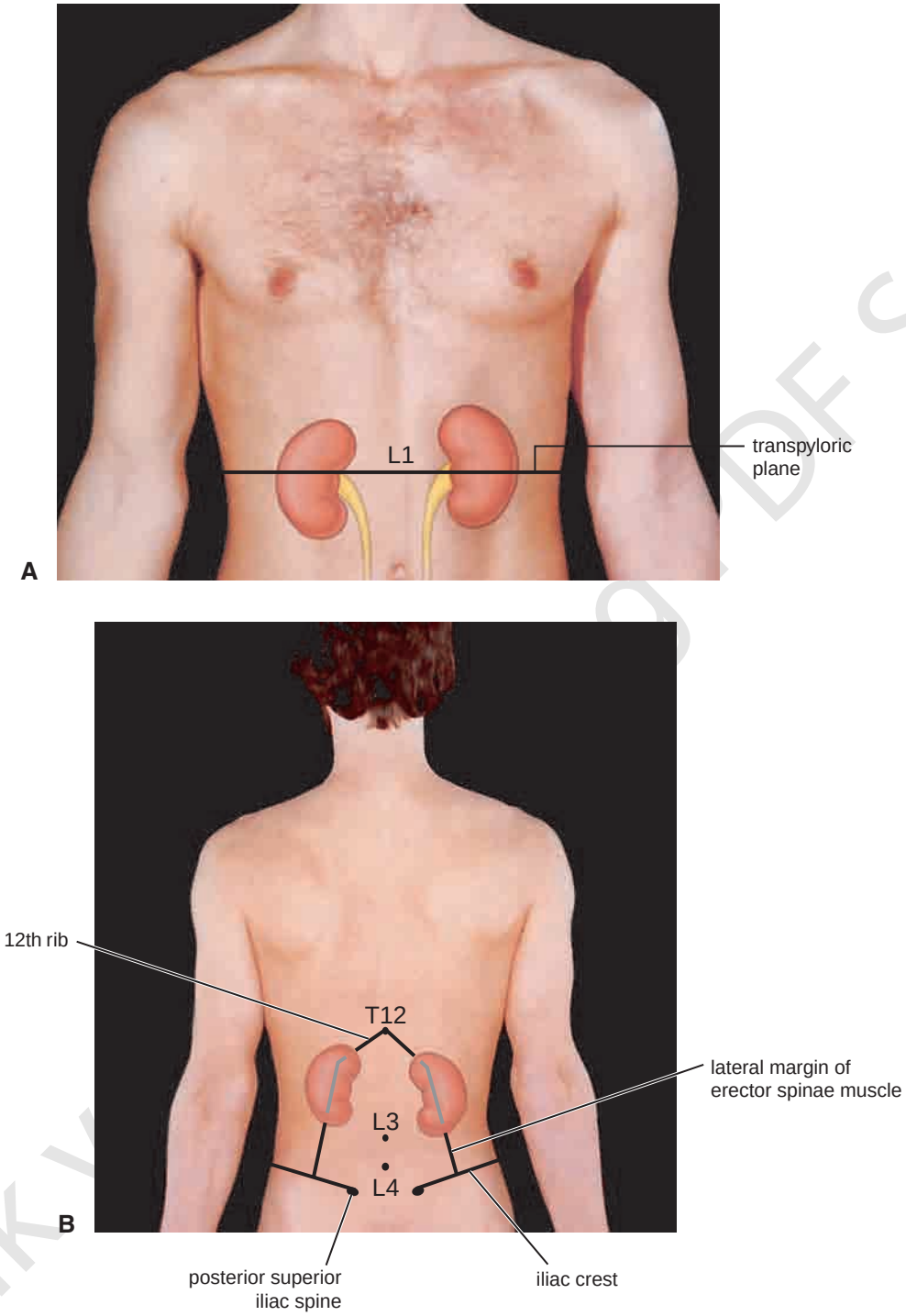

FIGURE 4.49 **A.** Surface anatomy of the kidneys and ureters on the anterior abdominal wall. Note the relationship of the hilum of each kidney to the transpyloric plane. **B.** Surface anatomy of the kidneys on the posterior abdominal wall.

Stomach

The **cardioesophageal junction** lies about three fingerbreadths below and to the left of the xiphisternal junction (the esophagus pierces the diaphragm at the level of the 10th thoracic vertebra).

The **pylorus** lies on the transpyloric plane just to the right of the midline. The **lesser curvature** lies on a curved line joining the cardioesophageal junction and the pylorus. The **greater curvature** has an extremely variable position in the umbilical region or below.

Duodenum (First Part)

The duodenum lies on the transpyloric plane about four fingerbreadths to the right of the midline.

Cecum

The cecum is situated in the right lower quadrant. It is often distended with gas and gives a resonant sound when percussed. It can be palpated through the anterior abdominal wall.

Appendix

The appendix lies in the right lower quadrant. The base of the appendix is situated one third of the way up the line, joining the anterior superior iliac spine to the umbilicus (McBurney's point). The position of the free end of the appendix is variable.

Ascending Colon

The ascending colon extends upward from the cecum on the lateral side of the right vertical line and disappears under the right costal margin. It can be palpated through the anterior abdominal wall.

Transverse Colon

The transverse colon extends across the abdomen, occupying the umbilical region. It arches downward with its concavity directed upward. Because it has a mesentery, its position is variable.

Descending Colon

The descending colon extends downward from the left costal margin on the lateral side of the left vertical line. In the left lower quadrant, it curves medially and downward to become continuous with the sigmoid colon. The descending colon has a smaller diameter than the ascending colon and can be palpated through the anterior abdominal wall.

Urinary Bladder and Pregnant Uterus

The full bladder and pregnant uterus can be palpated through the lower part of the anterior abdominal wall above the symphysis pubis (see page 260).

Aorta

The aorta lies in the midline of the abdomen and bifurcates below into the right and left common iliac arteries opposite the 4th lumbar vertebra—that is, on the intercristal plane. The pulsations of the aorta can be easily palpated through the upper part of the anterior abdominal wall just to the left of the midline.

External Iliac Artery

The pulsations of this artery can be felt as it passes under the inguinal ligament to become continuous with the femoral artery. It can be located at a point halfway between the anterior superior iliac spine and the symphysis pubis.

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