**LEARNING GOALS**
- Locate the liver.
- Clearly delineate the liver from its surroundings.
- Survey the total liver volume in multiple planes.
- Recognize portions of the liver that are difficult to scan.

The liver is the dominant organ of the right upper abdomen. It is protected by ribs and is covered mainly by the right costal arch. These simple anatomical facts are widely known, but they have special significance and implications for ultrasound scanning.

1. The liver is so large that it cannot be scanned adequately from one approach. A complete examination of the liver requires scanning from multiple angles and directions.
2. The liver cannot be scanned by the shortest route, but only from beneath the costal arch or between the ribs (Fig. 4.1). This means that while performing serial scans, you will view many sections of the liver more than once but are apt to miss blind spots if you are not fully familiar with the extent of the organ. Figure 4.2 illustrates this problem with an analogy.

**Locating the liver**

**Barriers to scanning**
- Ribs
- A high diaphragm

**Optimizing the scanning conditions**

To make the liver more accessible, have the patient raise the right arm above the head to draw the rib cage upward. Place the patient in the supine position and have him or her take a deep breath and hold it to expand the abdomen. One disadvantage of holding the breath is that it is followed by a period of hyperventilation, especially in older patients.
Organ identification

Start with the transducer placed transversely against the right costal arch, at the level where you would palpate the inferior border of the liver. Mentally picture the liver lying beneath the ribs, and angle the scan upward. Now ask the patient to take a deep breath, expanding the abdomen, and the liver will appear on the screen as a region of homogeneous echo texture. Figure 4.3 illustrates the view of the liver that is acceptable for organ identification.

Imaging the liver in its entirety

Because the liver is so large, it is best to proceed in steps when learning how to scan the entire organ.

1. Learn the outlines of the liver:
   - the inferior border,
   - the superior border,
   - the left border.

2. Survey the liver volume:
   - in longitudinal sections,
   - in subcostal transverse and oblique sections,
   - in intercostal sections.

Outlines of the liver

Defining the inferior border of the liver

The liver tapers inferiorly to a more or less sharp-angled border. This inferior border is easy to demonstrate with ultrasound. Place the transducer longitudinally on the upper abdomen, slightly to the right of the midline. Press the caudal end of the transducer a bit more deeply into the abdominal wall than the cranial end, so that the scan is directed slightly upward. This should bring the sharp inferior hepatic border into view (Fig. 4.4a).

Now slide the transducer to the left, keeping it in a longitudinal plane while following the line of the costal arch as closely as possible. Also, make sure that the inferior border of the liver stays at the right edge of the image. You can do this by varying the pressure on the transducer as needed.

As the transducer moves farther to the left, the cross section of the liver diminishes in size. Its roughly triangular outline becomes progressively smaller and finally disappears. The image is now dominated by a chaotic pattern of highly contrasting light and dark areas with no discernible shape, caused by the gas and liquid contents of the stomach.

Now return to the starting point and scan past it toward the right side. As you track across the abdomen, you will recognize the aorta and then the vena cava. As you scan past the vena cava, the gallbladder can be identified as a “black” structure in the fasted patient. With luck, the right kidney may also be seen. As the transducer moves farther to the right, the angle of the inferior hepatic border becomes increasingly blunted (Fig. 4.4b,c).

Visualization often becomes poor at this point, especially in obese patients and when there is interposed gas in the right colic flexure. It can be helpful to have the patient breathe in deeply and inflate the abdomen.

The series of images in Fig. 4.4 were selected to illustrate good scanning conditions. You should keep this in mind if you do not achieve the desired result right away. Figure 4.5 shows the appearance of a liver that is difficult to scan. This scan corresponds to the section in Fig. 4.4b.
After you have scanned across the inferior border of the liver once for orientation, make a second pass while giving attention to details. You have already seen that the inferior border has an approximately triangular shape in the ultrasound image. The anterior surface of the liver, which lies against the abdominal wall, is flat and smooth. The posterior surface is slightly concave in its lower portion and becomes slightly convex superiorly (Fig. 4.6). The angle between the anterior and posterior surfaces is 30–45° on the left side and 45–70° on the right side (Fig. 4.7). The posterior surface has several concavities that interrupt its triangular shape: the porta hepatis and the impressions from the gallbladder and right kidney.

![Fig. 4.4 Demonstrating the inferior border of the liver](image)

- **a** Scan of the left hepatic lobe, with the transducer placed approximately in the midline. Note the sharp angle of the inferior border (T).
- **b** The transducer was moved toward the right side, approximately to the midclavicular line. The inferior border appears less sharp (T).
- **c** The transducer was moved farther to the right. Now the inferior border cannot be clearly defined. The angle is relatively blunt (T).

![Fig. 4.5 The inferior border of this liver (T) is difficult to scan.](image)

![Fig. 4.6 Shape of the inferior border.](image)

Note that the posterior surface of the liver is concave below (toward the inferior border) and convex above.

![Fig. 4.7 Angle of the inferior border](image)

- **a** Left side of the liver.
- **b** Right side of the liver.
4 Liver

Figure 4.8 illustrates a series of longitudinal sections of the inferior hepatic border obtained by scanning across the liver from left to right. Notice the changes in the liver outline caused by the gallbladder and kidney.

Abnormalities and variants of the inferior border

Fatty liver. Besides increased echogenicity (see p. 53 ff.), fatty infiltration of the liver leads to rounding and broadening of the inferior border (Figs. 4.9, 4.10).

Cirrhosis of the liver. The normal liver presents a smooth inferior surface contour. With cirrhosis, regenerative nodules in the liver produce a lobulated contour (Fig. 4.11).

Riedel’s lobe. Riedel’s lobe is a tongue-like inferior projection of the right lobe that extends well past the lower pole of the kidney (Fig. 4.12).
Defining the superior border of the liver

The superior border of the liver is flat on the left side and convex on the right side. The scanning technique is similar to that for the inferior border. Place the transducer longitudinally to the right of the midline just below the costal arch. Angle upward until the superior border of the liver appears on the left side of the screen. Notice the bright echo return from the diaphragm. The pulsating heart can be seen cranially (left side of the image).

Now scan toward the left in parallel longitudinal sections, following the line of the costal arch, until you reach the end of the liver. Then return to the right and continue the scan along the right costal arch (Fig. 4.13). You will need to apply firmer transducer pressure in this region in order to scan beneath the ribs at a relatively flat angle.

Repeat the longitudinal pass along the superior border of the liver, this time noticing the shape of the hepatic cross section. The superior border of the liver is flat on the left side. The heart rests upon the diaphragm in this area. The superior surface of the liver forms a right angle with its anterior surface (Fig. 4.14). The farther the transducer is moved toward the right, the more convex the surface becomes. At this point you will have to press harder on the transducer and scan beneath the ribs at a relatively steep angle to view the part of the diaphragm that borders the liver. Even so, it is often not possible to define the full cross section of the liver on the left side of the screen, and a portion of the liver will appear cut off (Fig. 4.15).

**T I P**

Press firmly with the transducer along the right costal arch so that you can scan beneath the ribs at a relatively flat angle.

**Fig. 4.13** Demonstrating the superior border of the liver

- a Superior border of the left lobe (†††). The transducer was placed approximately in the midline.
- b The transducer was moved to the right. Notice that the liver does not transcend the left edge of the image, indicating a complete section (†).
- c The transducer was moved farther to the right. Now the anterior superior portion of the liver is not included in the image (†). Compare this scan with Fig. 4.15.

**K E Y  P O I N T**

Anterior and superior portions of the liver near the diaphragm are often poorly visualized in longitudinal scans.
Try to picture mentally which portion of the liver is not seen. Recall that in a longitudinal scan, the left side of the screen is cranial and the right side is caudal. But as the transducer is angled cephalad, the angle of the scan becomes more horizontal and this rule becomes less valid. With a flat scanning angle, anterior portions of the liver are displayed on the left side of the screen. For our purposes, this means that the hidden, “truncated” portion of the liver cross section is anterior and superior. This blind spot is shown schematically in Fig. 4.16.

Defining the left border of the liver

The left border of the liver was already seen in the longitudinal sections of the superior and inferior borders. Now you will also scan down the left border in transverse sections. Place the transducer in a transverse or slightly oblique position along the costal arch, a little to the left of the midline. Scan up toward the liver beneath the costal arch, angling the probe upward until you see the pulsating heart. Scan at a very steep angle so that the left border of the liver is just visible on the screen. Now scan down the left border by angling the transducer. Notice how the shape of the liver section changes as the scan moves downward, changing from trapezoidal above (Fig. 4.17a) to triangular below (Fig. 4.17b,c).
The tables in this chapter serve as a “sono consultant”—a systematic framework for helping the examiner to evaluate specific ultrasound findings and make a differential diagnosis.

The chapter consists of two parts, which represent the situations that beginners will most often encounter in ultrasound examinations:

Part I: The examiner sees an abnormality at ultrasound and wants to analyze it in a systematic way.

Part II: The examiner is consulted for the ultrasound evaluation of a specific clinical situation.

Part I, Ultrasound Findings, provides a comprehensive, step-by-step approach for systematically analyzing an abnormality that is noted during an ultrasound examination.

Part II, Clinical Presentation, offers guidelines for interpreting findings and extracting the maximum amount of information that ultrasonography can supply in a given clinical situation.

Both parts deal with the most common sonographic findings and clinical situations that arise in diagnostic ultrasonography. Of course, the exact sequence of steps for interpreting ultrasound findings will vary considerably from one examiner to the next. The goal of this chapter is to provide the beginner with a logical, structured routine that will train and reinforce a complete, systematic ultrasound examination.
## Ultrasound Findings

### 1. Aorta: Widening

<table>
<thead>
<tr>
<th>Finding</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify, measure in two dimensions</td>
<td></td>
</tr>
<tr>
<td>&lt; 25 mm</td>
<td>Normal</td>
</tr>
<tr>
<td>25–30 mm</td>
<td>Ectasia</td>
</tr>
<tr>
<td>&gt; 30 mm</td>
<td>Aneurysm</td>
</tr>
<tr>
<td>&gt; 50 mm</td>
<td>High risk of rupture</td>
</tr>
</tbody>
</table>

**Full-length visualization of the aorta**

- **Longitudinal shape**
  - Straight
  - Curved Kinked?

- **Wall**
  - Circumscribed plaques, diffuse thickening Aortic sclerosis?

- **Lumen**
  - Echo-free
  - Echogenic
  - Floating membrane Dissecting aneurysm

- **Location**
  - Start and end of the dilatation
  - Relationship to vessels
    - Suprarenal
    - Infrarenal?

- **Aortic branches**
  - Vessel origins
  - Iliac vessels
2. **Vena cava: Dilatation**

<table>
<thead>
<tr>
<th>Finding</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Verify, measure</strong></td>
<td></td>
</tr>
<tr>
<td>&lt; 20 mm in late inspiration and end expiration</td>
<td>Normal</td>
</tr>
<tr>
<td>&gt; 20 mm</td>
<td>Suspicious for abnormal dilatation</td>
</tr>
<tr>
<td><strong>Pulsation, respiration, lumen</strong></td>
<td></td>
</tr>
<tr>
<td>Double-beat pattern synchronous with the pulse</td>
<td></td>
</tr>
<tr>
<td>- Present</td>
<td>Physiologic dilation?</td>
</tr>
<tr>
<td>- Not present</td>
<td>Young, thin patient?</td>
</tr>
<tr>
<td>Luminal change with respirations</td>
<td></td>
</tr>
<tr>
<td>- Present</td>
<td>Physiologic dilation?</td>
</tr>
<tr>
<td>- Not present</td>
<td>Stasis?</td>
</tr>
<tr>
<td>Lumen</td>
<td></td>
</tr>
<tr>
<td>- Echo-free</td>
<td>Stasis?</td>
</tr>
<tr>
<td>- Echogenic</td>
<td>Thrombus?</td>
</tr>
<tr>
<td><strong>Other signs of congestive failure</strong></td>
<td></td>
</tr>
<tr>
<td>Visualization of all vena cava tributaries</td>
<td></td>
</tr>
<tr>
<td>- Hepatic veins</td>
<td></td>
</tr>
<tr>
<td>- Renal veins</td>
<td></td>
</tr>
<tr>
<td>- Iliac vessels</td>
<td></td>
</tr>
<tr>
<td>Liver</td>
<td></td>
</tr>
<tr>
<td>- Echo pattern</td>
<td></td>
</tr>
<tr>
<td>- Borders</td>
<td></td>
</tr>
<tr>
<td>- Size</td>
<td></td>
</tr>
<tr>
<td>Ascites?</td>
<td></td>
</tr>
</tbody>
</table>
## Clinical Presentation

### 1. Splenomegaly

<table>
<thead>
<tr>
<th>Finding</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify, measure</td>
<td></td>
</tr>
<tr>
<td>&lt; 11.5 cm</td>
<td>No splenomegaly</td>
</tr>
<tr>
<td>&gt; 12.5 cm</td>
<td>Splenomegaly?</td>
</tr>
<tr>
<td><strong>Echo pattern</strong></td>
<td></td>
</tr>
<tr>
<td>Homogeneous</td>
<td>Portal hypertension?</td>
</tr>
<tr>
<td></td>
<td>Hemolytic anemia?</td>
</tr>
<tr>
<td></td>
<td>Heart failure?</td>
</tr>
<tr>
<td></td>
<td>Epstein–Barr virus?</td>
</tr>
<tr>
<td></td>
<td>Storage disease?</td>
</tr>
<tr>
<td>Inhomogeneous</td>
<td>Lymphoma?</td>
</tr>
<tr>
<td></td>
<td>Hematologic disease?</td>
</tr>
<tr>
<td><strong>Look for signs of portal hypertension</strong></td>
<td>Portal hypertension?</td>
</tr>
<tr>
<td>Splenic hilar vessels dilated, splenic vein dilated, portal vein dilated, signs of hepatic cirrhosis, ascites on right side</td>
<td></td>
</tr>
<tr>
<td><strong>Look for signs of hematologic disease</strong></td>
<td>Lymphoma?</td>
</tr>
<tr>
<td>Enlarged lymph nodes</td>
<td>Hematologic disease?</td>
</tr>
</tbody>
</table>
# Table of Contents

## 1 General

- How to Use This Book .................................................. 1
- Examination Technique and Equipment .............................. 2
  - Who do you examine first when learning to scan? ............... 2
  - How do you adjust the ultrasound machine? ...................... 2
  - What can you do with the transducer? ............................... 4

## 2 Basic Physical and Technical Principles

- Ultrasound ......................................................................... 10
  - Definitions ....................................................................... 10
  - Propagation of sound .................................................... 10
  - Production and detection of ultrasound waves:
    - the pulse-echo principle ............................................. 11
  - Diagnostic ultrasound: propagation of ultrasound in biological tissue ..................................................... 11
- Producing an Image .......................................................... 12
  - A-Mode ......................................................................... 12
  - B-Mode ......................................................................... 13
  - M-Mode ......................................................................... 13
- Artifacts ............................................................................ 14
  - Noise .............................................................................. 14
  - Acoustic shadowing ........................................................ 14
  - Posterior acoustic enhancement ...................................... 14
  - Reverberations ................................................................ 14
  - Beam-width artifact ....................................................... 15
  - Side-lobe artifact ........................................................... 16
  - Mirror-image artifact .................................................... 17
  - Lateral edge shadow ....................................................... 18

## 3 Blood Vessels: The Aorta and its Branches, the Vena Cava and its Tributaries

- Organ Boundaries ........................................................... 19
  - Locating the aorta and vena cava .................................... 19
  - Demonstrating the aorta and vena cava in their entirety ...... 20
- Organ Details .................................................................... 22
  - Demonstrating arterial and venous pulsations .................... 22
  - Evaluating the vessel walls and lumina ............................. 22
  - Identifying and defining the branches of the aorta and vena cava ......................................................... 24
- Anatomical Relationships .................................................. 28
  - Relationship of the aorta and vena cava to the diaphragm, liver, and cardia .............................................. 28
  - Area surrounding the celiac trunk and the course of the hepatic artery, splenic artery, and left gastric artery .... 29
<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior mesenteric artery, splenic vein, and renal vessels</td>
</tr>
<tr>
<td>Iliac vessels</td>
</tr>
<tr>
<td>Lymph nodes near the retroperitoneal vessels</td>
</tr>
<tr>
<td>Liver</td>
</tr>
<tr>
<td>Organ Boundaries</td>
</tr>
<tr>
<td>Locating the liver</td>
</tr>
<tr>
<td>Imaging the liver in its entirety</td>
</tr>
<tr>
<td>Organ Details</td>
</tr>
<tr>
<td>Shape</td>
</tr>
<tr>
<td>Size</td>
</tr>
<tr>
<td>Parenchymal pattern</td>
</tr>
<tr>
<td>Vessels of the liver</td>
</tr>
<tr>
<td>Division of the liver into lobes, segments, and subsegments</td>
</tr>
<tr>
<td>The portal vein and its branches</td>
</tr>
<tr>
<td>Anatomical Relationships</td>
</tr>
<tr>
<td>Relationship of the left portion of the liver</td>
</tr>
<tr>
<td>to the heart and stomach</td>
</tr>
<tr>
<td>Relationship of the central portion of the liver</td>
</tr>
<tr>
<td>to the vena cava, stomach, and pancreas</td>
</tr>
<tr>
<td>Relationship of the right portion of the liver</td>
</tr>
<tr>
<td>to the gallbladder, duodenum, and kidney</td>
</tr>
<tr>
<td>Ascites</td>
</tr>
<tr>
<td>Porta Hepatis</td>
</tr>
<tr>
<td>Organ Boundaries: Identifying the Vessels in the Porta Hepatis</td>
</tr>
<tr>
<td>Vena cava and portal vein</td>
</tr>
<tr>
<td>Hepatic artery and bile duct</td>
</tr>
<tr>
<td>Transverse and longitudinal survey of the porta hepatis</td>
</tr>
<tr>
<td>Organ Details: Details of the Vessels in the Porta Hepatis</td>
</tr>
<tr>
<td>Portal vein</td>
</tr>
<tr>
<td>Gallbladder</td>
</tr>
<tr>
<td>Organ Boundaries</td>
</tr>
<tr>
<td>Locating the gallbladder</td>
</tr>
<tr>
<td>Imaging the entire gallbladder</td>
</tr>
<tr>
<td>Variable position of the gallbladder</td>
</tr>
<tr>
<td>Nonvisualization of the gallbladder</td>
</tr>
<tr>
<td>Organ Details</td>
</tr>
<tr>
<td>Regions of the gallbladder</td>
</tr>
<tr>
<td>Size of the gallbladder</td>
</tr>
<tr>
<td>Variable shape of the gallbladder</td>
</tr>
<tr>
<td>Gallbladder wall</td>
</tr>
<tr>
<td>Gallbladder contents</td>
</tr>
<tr>
<td>Special acoustic phenomena in gallbladder scanning</td>
</tr>
<tr>
<td>Anatomical Relationships</td>
</tr>
<tr>
<td>Relationship of the gallbladder to the liver</td>
</tr>
<tr>
<td>Relationship of the gallbladder to the portal vein</td>
</tr>
<tr>
<td>Relationship of the gallbladder to the antrum, bulb, and duodenum</td>
</tr>
</tbody>
</table>
7 Pancreas

Organ Boundaries ....................................................... 135
Locating the pancreas .............................................. 135
Imaging the entire pancreas .................................... 138
Variable shape of the pancreas .............................. 140
Organ Details .......................................................... 141
Pancreatic parenchyma ......................................... 141
Pancreatic duct ....................................................... 145
Common bile duct .................................................. 146
Measuring the pancreatic diameter ......................... 148
Anatomical Relationships .......................................... 149
Relationships of the tail of the pancreas .................... 149
Relationships of the body of the pancreas ................. 152
Relationships of the head of the pancreas ................. 156

8 Stomach, Duodenum, and Diaphragm

Organ Details .......................................................... 165
Stomach wall ........................................................... 165
Organ Boundaries and Relationships ......................... 166
Esophagus and cardia ............................................... 166
Body of the stomach ............................................... 170
Antrum and duodenum .............................................. 172
Diaphragm .............................................................. 176

9 Spleen

Organ Boundaries ....................................................... 178
Locating the spleen .................................................. 178
Imaging the entire spleen ........................................ 179
Organ Details .......................................................... 181
Shape of the spleen .................................................. 181
Determining the size of the spleen ............................ 182
Echo pattern ........................................................... 183
Anatomical Relationships .......................................... 186
Relationship of the spleen to the pancreas, kidney, colic flexure, and stomach .......................... 187
Relationship of the spleen to the pleura ...................... 189

10 Kidneys

Organ Boundaries ....................................................... 191
Locating the right kidney ........................................ 193
Imaging the entire right kidney ............................... 195
Locating the left kidney .......................................... 197
Imaging the entire left kidney ................................... 198
Organ Details .......................................................... 200
Size and shape of the kidneys ................................ 200
Renal parenchyma and renal sinus ......................... 204
Anatomical Relationships of the Right Kidney ............. 214
Relationship of the right kidney to the liver .............. 215
Relationship of the right kidney to the psoas and quadratus lumborum muscles ...................... 218
Table of Contents

Relationship of the right kidney to the colon ...................... 221
Relationship of the right kidney to the gallbladder ................... 223
Anatomical Relationships of the Left Kidney ......................... 226
Relationship of the left kidney to the spleen ...................... 227
Relationship of the left kidney to the psoas and quadratus lumbarum muscles ..................... 229
Relationship of the left kidney to the colon ...................... 229

11 Adrenal Glands ..................................................... 230
Organ Boundaries and Anatomical Relationships ...................... 231
Ultrasound morphology of the adrenal glands ..................... 231
Location of the adrenal glands .................................... 231
Right adrenal gland .............................................. 232
Left adrenal gland ............................................... 234
Organ Details ..................................................... 235
Abnormalities of the adrenal glands ................................ 235

12 Bladder, Prostate, and Uterus .................................... 236
Organ Boundaries and Relations .................................... 236
Bladder and prostate .......................................... 236
Bladder and uterus ............................................... 238
Organ Details ..................................................... 240
Prostate ......................................................... 240
Uterus ......................................................... 240

13 The Systematic Ultrasound Examination ....................... 241
Topographic Units ................................................ 242
Liver ......................................................... 242
Gallbladder and porta hepatitis .................................... 242
Right kidney .................................................... 243
Left kidney and spleen .......................................... 243
Epigastrium and pancreas ........................................ 244
Midabdomen ................................................... 244
Lower abdomen .................................................. 244
Description of Findings and Nomenclature ....................... 245
Documentation .................................................. 246
Written report ................................................... 246
Image documentation ........................................... 246

14 The Sono Consultant ............................................... 248
1 Ultrasound Findings ............................................ 249
1. Aorta: Widening ............................................. 249
2. Vena cava: Dilatation ......................................... 250
3. Liver: Large .................................................. 251
4. Liver: Small .................................................. 252
5. Liver: Increased echogenicity ................................ 253
6. Liver: Hepatic veins dilated .................................... 254
7. Liver: Circumscribed mass ..................................... 254
8. Liver: Echo-free mass .......................................... 255
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Liver: Hypoechoic mass</td>
<td>256</td>
</tr>
<tr>
<td>10. Liver: Isoechoic or hyperechoic mass</td>
<td>257</td>
</tr>
<tr>
<td>11. Liver: Hyperechoic mass with an acoustic shadow</td>
<td>257</td>
</tr>
<tr>
<td>12. Ascites</td>
<td>258</td>
</tr>
<tr>
<td>13. Gallbladder: Stone</td>
<td>259</td>
</tr>
<tr>
<td>14. Gallbladder: Circumscribed wall changes</td>
<td>260</td>
</tr>
<tr>
<td>15. Gallbladder: Thickened wall</td>
<td>261</td>
</tr>
<tr>
<td>16. Gallbladder: Large</td>
<td>262</td>
</tr>
<tr>
<td>17. Gallbladder: Echogenic contents</td>
<td>263</td>
</tr>
<tr>
<td>18. Gallbladder: Acoustic shadowing</td>
<td>264</td>
</tr>
<tr>
<td>19. Common duct: Dilatation</td>
<td>264</td>
</tr>
<tr>
<td>20. Pancreas: Dilated duct</td>
<td>266</td>
</tr>
<tr>
<td>21. Pancreas: Cannot be identified</td>
<td>267</td>
</tr>
<tr>
<td>22. Pancreas: Increased echogenicity</td>
<td>267</td>
</tr>
<tr>
<td>23. Spleen: Circumscribed changes</td>
<td>268</td>
</tr>
<tr>
<td>24. Spleen: Circumscribed change, echo-free</td>
<td>269</td>
</tr>
<tr>
<td>25. Spleen: Circumscribed changes, hypoechoic</td>
<td>269</td>
</tr>
<tr>
<td>26. Spleen: Circumscribed changes, hyperechoic</td>
<td>270</td>
</tr>
<tr>
<td>27. Spleen: Circumscribed changes, hyperechoic with shadow</td>
<td>270</td>
</tr>
<tr>
<td>II Clinical Presentation</td>
<td>271</td>
</tr>
<tr>
<td>1. Splenomegaly</td>
<td>271</td>
</tr>
<tr>
<td>2. Lymphoma</td>
<td>272</td>
</tr>
<tr>
<td>3. Heart failure</td>
<td>273</td>
</tr>
<tr>
<td>4. Hypertension</td>
<td>273</td>
</tr>
<tr>
<td>5. Jaundice</td>
<td>274</td>
</tr>
<tr>
<td>6. Acute viral hepatitis (ultrasound is inconclusive)</td>
<td>275</td>
</tr>
<tr>
<td>7. Chronic viral hepatitis</td>
<td>276</td>
</tr>
<tr>
<td>8. Primary sclerosing cholangitis</td>
<td>277</td>
</tr>
<tr>
<td>9. Proposed laparoscopic cholecystectomy</td>
<td>278</td>
</tr>
<tr>
<td>10. Postcholecystectomy syndrome</td>
<td>279</td>
</tr>
<tr>
<td>11. Acute pancreatitis</td>
<td>279</td>
</tr>
<tr>
<td>12. Chronic pancreatitis</td>
<td>281</td>
</tr>
<tr>
<td>13. Hematuria</td>
<td>282</td>
</tr>
<tr>
<td>14. Chronic renal failure</td>
<td>283</td>
</tr>
<tr>
<td>15. Chronic renal failure, small to normal-sized kidney</td>
<td>283</td>
</tr>
<tr>
<td>16. Chronic renal failure, large kidney</td>
<td>283</td>
</tr>
<tr>
<td>17. Acute right-upper-quadrant pain</td>
<td>284</td>
</tr>
<tr>
<td>18. Diabetes mellitus</td>
<td>285</td>
</tr>
<tr>
<td>Index</td>
<td>286</td>
</tr>
</tbody>
</table>
Index

Numbers in italics indicate figures.

A
A-mode 12, 13
abdomen
  basic scanning strategies 1
  lower, examination and reporting 244
  midabdomen, examination 244
diagnostic units 241, 241–244
  abdominal pain, acute right-upper-quadrant 284
abdominal ultrasound, standard scan planes 6, 6
abscess
  adrenal 207
  kidney 207, 207
  liver 57, 57
  pancreatic 143, 143
  spleen 185
absorption, sound 11
accompanying findings 28
adenoma
  gallbladder 123, 123
  liver 56, 57
  prostate 240
adrenal glands 230–235
  abnormalities 235, 235
  abscess 207
anatomical landmarks 232
anatomical relationships 231–234
  boundaries 231–234
  carcinoma 235
  children 233, 233
  cysts 207, 207
details 235
dimensions 231
  in hypertension 273
  indications for ultrasound 230
left 231, 231, 234, 234
location 231, 231
metastasis 235
renal vesicles and 22
  right 231, 231, 232–233, 233
  longitudinal scan 232, 232
  transverse scan 233, 233
tumors 230, 233
  nonfunctioning 230, 235
age-related changes
  aorta 21
  kidney 203, 210
  pancreas 141
  air in bile ducts 60, 60
  in bowel see bowel gas
alcoholic cirrhosis of liver 46, 46
amplitude, echo 12, 13
ampullary pelvis 211, 212
anaglactic nephropathy 210, 210
  aneurysm, aortic see aortic aneurysm
  angiomatolipoma, kidney 208, 208
angling movement 7, 7, 9, 9
antrum see gastric antrum; pyloric antrum
aorta 20–21
  abnormalities in course 21, 21
  age-related changes 21
  anatomical relationships 28–32
  atherosclerotic plaque 23, 23
  bifurcation 20, 20, 38
    demonstrating 26, 26
  bowel gas obscuring 20, 20, 21, 21
    branches 24, 24–26
  cardi and 28, 28
celiac trunk and 25, 25, 32, 32
colon and 19
diameter 22
  diaphragm and 28, 28, 176, 177, 177
  elongation 21
gastric antrum and 174
  gastroesophageal junction and 91, 167
  in hypertension 273
  imaging in entirety 249
  kidney relationship 202
  kinking 21, 21
  liver and 28, 28
  locating 19, 19–20
  longitudinal section 20, 20–21, 21, 22, 22,
    26, 26, 30, 31
  lumen abnormalities 23–24
  lymph node distribution 40, 41, 42
  organ boundaries 19, 19–20
  pancreas and 136, 136, 137, 139
  porta hepatitis and 96, 97, 99
  portal vein and 83
  pulsation 22–24
  renal vessels and 35, 35, 36
  splenic vein and 102, 103
  superior mesenteric artery and 25, 25, 33
  systematic analysis of findings 249
  thoracic 20, 20
  transverse section 20, 20, 21, 25, 26
  wall 22, 22
  abnormalities 23–24
  widening 249
  aortic aneurysm 23, 23–24
  enlargement/size 24
  arterial pulsation 22–24
arteries see individual arteries
  artifacts 14–18
  gallbladder 14, 18, 123, 123–124, 124
  ascites 54, 55, 95, 258
  gallbladder wall thickening 119
  in hepatic cirrhosis 61
  between kidney and liver 216
  spleen and 190, 190
  atherosclerotic plaque 23, 23
B
B-mode 13, 13
beam-width artifact 15, 15, 123
  bile duct(s) 96, 96
  abnormalities 105, 105
  acute right-upper-quadrant pain 284
  air in 60, 60
dilatation 264
dimensions 105
  interpretation of findings 264–265
  intrahepatic 60, 60, 277
  abnormalities 61, 61
dilated 62, 62
  in jaundice 274
obstruction 105, 105
outflow obstruction 105, 265
porta hepatitis and 96, 96, 98, 99, 100
sludge 105, 105, 113, 115
stones 105
see also common bile duct; common
  hepatic duct
biliary sludge 105, 105, 113, 115
biliary tract 259
  bladder 236–237
  diverticulum 240
hematuria 282
  longitudinal section 236, 236
  prostate relationship 236, 236–237, 237
  transverse section 237, 237
  uterus relationship 238, 238–239, 239
  wall thickening 240
blood vessels 19–42
  see also specific arteries/veins
  body composition 11–12
  bowel gas 20, 124, 124
  left kidney scan 229
  obscuring aorta/vena cava 20, 20, 21, 21
  right kidney scan 221
breathing
  liver scans 43, 44
  porta hepatitis scans 97
  spleen scans 189, 189
  vena cava scans 22, 22
Budd–Chiari syndrome 104
C
calculations
  gallbladder 120
  kidney 209, 209
  liver see liver
  pancreas 142, 142
  spleen 184, 184
carcinoma
  adrenal glands 235
  colon, hepatic metastases 56, 56, 59, 60
  gallbladder 119, 123
  gastric 41, 165
  hepatocellular 57, 57
  pancreatic head 144, 144, 164, 148
  renal cell, hepatic metastases 56, 56
  urothelial, liver metastases 55
cardia 160–169
  anatomical relationships 167, 167–168, 168
  aorta relationship 28, 28
  liver relationship 91, 91
  vena cava relationship 28, 28
  see also gastroesophageal junction
  caudate lobe see liver
celiac trunk 24, 24
  area surrounding 28, 28–32
  bifurcation 32, 41
  branches 28
  demonstrating 25, 25
  diaphragm and 177
  esophagus and 166
  longitudinal section 28, 28, 30, 31
  pancreas and 136, 136, 137
  cholangitis, primary sclerosing 105, 277
cholecystectomy
  prior, nonvisualization of gallbladder 111, 112
  proposed laparoscopic, findings 278
  scars 111, 112
Index

cholecytitis
acute 118, 118
gallbladder wall 118, 118
chronic 118, 118
gallbladder wall 118, 118
choleystolithiasis 119
cholesterol polyps 122, 122
cholesterol-rich gallstone 120
chronic viral hepatitis 276
chyme 174
cirrhosis of liver 54, 54
alcoholic 46, 46
portal vein cutoff/narrowing 61, 61
sonographic findings 61
colic flexure 193
impression on liver 215
left, left kidney relationship 226, 229, 229
right
right kidney relationship 214, 215, 221, 222, 222
variable position 221, 221
spleen relationship 186, 187, 187–188, 188
colon
aorta and 19
carcinoma, hepatic metastases 56, 56, 59, 60
gallbladder and 126
gas see bowel gas
left kidney relationship 226, 229, 229
pancreas and 135
right kidney relationship 221, 221–222, 222
spleen and 181, 187
comet-tail artifact 14, 15
common bile duct 146–148, 264–265, 278
abnormalities 148, 148
dilatation 146, 148, 264
gastric antrum and 146
in jaundice 274
longitudinal sections 147, 147
obstruction 148, 265, 274
renal veins and 147, 156
stone 105, 105
transverse sections 146, 147
vena cava and 147
see also bile duct(s);
common hepatic duct
common hepatic artery 28, 28
common hepatic duct 264–265
bifurcation 105
porta hepatis and 96, 96
see also bile duct(s)
common iliac artery 38
common iliac vein 38, 39
congestive heart failure 250, 273
coronal section 5, 5
costal arch 34, 43, 47, 77, 107
costodiaphragmatic recess 186, 189
crura see diaphragm
Cruevelhier-von Baumgarten syndrome 66
cyst(s)
adrenal 207
extrarenal 209, 209
liver 14, 55, 55
parapelvic 206, 207, 213, 213
pararenal 206
parastatic, liver 55, 55
renal see kidney, cysts
solitary nonparasitic, of liver 55, 55
spleen 185
cystic duct 98

D

diabetes mellitus 285
diabetic nephropathy 203, 203, 285
diagnostic ultrasound, principles 11–12
diaphragm 176–177
aorta and 176, 176, 177
celiac trunk and 177
crura 28, 30, 176, 176, 177
right, adrenal gland and 233, 233
enlarged lymph nodes and 177
longitudinal sections 177, 177
transverse sections 176, 177
vena cava and 176, 176, 177
dissecting aortic aneurysm 23, 23
documentation 246–247
image 246–247
“double barrel shotgun” sign 62
Douglas’ cul-de-sac 238
ductus venosus 67–68
duodenal bulb 164, 174
gallbladder relationship 132, 132
longitudinal section 173
pancreatic body relationship 154, 154
pancreatic head relationship 156
transverse section 175
duodenal diverticulum 173
duodenum 164–177, 174
C-loop 161
gallbladder relationship 132–134, 132–134
gas 15, 124, 124, 132
kidney relationship 214
liver relationship 92, 93–94, 94
longitudinal sections 172–173, 173
lumen, hyperechoic, white or nonhomogeneous 162
pancreatic head relationship 160–163, 160–163
scan plans 164
transverse sections 174–175, 175
vena cava and 174, 175

E

Echinococcus granulosus, hepatic cysts 55, 55
echo 10, 11, 12, 13
ectopic kidney 199
edge shadow 18, 18
epigastric pain 284
epigastrum, examination and reporting 244
equipment 2–9
see also transducers; ultrasound machine
esophageal hiatus, anatomy 176
esophagus 166–169
anatomical relationships 167, 167–168, 168
celiac trunk and 166
vena cava and 167, 168
see also gastroesophageal junction
examination
documentation 246–247
first subject 2
interpretation of findings 248–270
principles 10–18
specific conditions 271–285
systematic 241–247
techniques 2–9
written reports 246

F

falciform ligament 62, 63
fatty liver 46, 46, 53, 54
focal sparing and 57, 57
fibrolipomatosis, pancreatic 142, 142
findings, description 245
fissure, interlobar 127, 127, 128, 128
focal nodular hyperplasia (FNH), liver 56, 57
food, bolus in duodenum 124, 124
frequencies 4, 10
fusiform aortic aneurysm 23, 23

G

gallbladder 106–134
acoustic phenomena/artifacts 14, 18, 123, 123, 124
acoustic shadowing 264
acute right-upper-quadrant pain 284
acute viral hepatitis 275
adenoma 123, 123
anatomical relationships 125–134
anterior approach 106
in ascites 119
barriers to scanning 106
beam-width artifact 15, 123, 123
bed, liver relationship 126, 126, 128, 128
body 114, 114
boundaries 106
calcification 120
carcinoma 123, 123
wall thickness 119
caudate lobe of liver and 68
cholecystectomy and 111, 112
cholesterol polyps 122, 122
colon and 126
contents 119–122, 263, 278
abnormal 120–122, 120–122
see also gallstones
details 114–124
dimensions 114
duodenum relationship 132–134, 132–134
echogenic 122, 122
echogenic contents, interpretation 263
dashed shadows 18, 123, 123
enlargement 115, 115
interpretation 262
examination procedure 242
fundus 114, 114, 116, 131
stones 121, 121
gastric antrum relationship 132, 132, 133, 133
in hepatic cirrhosis 61
hepatic vein and 79
hydropic 115
imaging in entirety 108–110, 108–110
infundibulum 114, 114
stones 121, 121
intercostal flank scans 109–110, 110
interlobar fissure and 127, 127, 128, 128
kidney (right) relationship 214, 223–225, 223–225
landmarks for 106, 127, 127
lateral approach 106
lateral edge shadows 18, 123, 123
ligamentum teres and 64, 67, 67
liver relationship 92, 93–94, 94, 107, 126–128, 126–128
in liver scan 44
locating/identifying 106–107, 107
lower right costal image 125, 125, 126
neck 114, 114, 129, 130
artifacts 124
polyp 124, 124
nonvisualized 111–113, 112
normal 115, 115, 119
obesity and 112, 112
Index

pancreas and 126, 126
“Phrygian cap” 116, 116
polyoid lesions 122, 122–123, 123
polyoid sludge 123
polyps 122, 122, 124, 124
porcelain 119, 119
portal vein relationship 83, 85, 129, 129–131
longitudinal section 129, 131, 131
transverse section 129, 130, 130
postprandial contraction 105, 112, 112, 117
pseudosludge 15
regions 114, 114
reporting guidelines 242–243, 242–243
S-shaped 116
sand 122, 122
sediment in 115, 115
shape variations 116, 116
shrunken 113, 113, 121
size 114, 114–115, 115, 259
sludge 115, 121, 121
splenic vein and 129
stones see gallstones
superior mesenteric vein and 129, 133
systematic analysis of findings 259–264
upper abdominal longitudinal scans 109, 109, 114, 125, 129, 134
upper abdominal transverse scans 108, 108, 114, 125, 129, 133
variable position 111, 111
vena cava and 132, 133, 134
wall 117, 117–119, 278
abnormalities 117–119, 118
encapsulated changes 260
gangrenous 118, 118
thickened, interpretation 261
thickening in ascites 119
thickness, measurement 117
gallstones 37, 113, 120–121, 259
calcium-rich 120
characteristics 259
cholesterol-rich 120
false-positive/false-negative diagnosis 121
infundibular 121, 121
large solitary 120
multiple 120
in right kidney scan 224
gas see bowel gas
gastric antrum 172–175, 174
aorta and 174
common bile duct and 146
duodenum and 172–175, 172–175
gallbladder relationship 132, 132, 133, 133
kidney and 215
liver relationship 92, 92, 172, 173
longitudinal sections 172, 172–173
pancreas and 163
spleen and 187
transverse sections 174, 174–175, 175
vena cava and 174, 175
see also pyloric antrum
gastric artery, left 24, 24
course 28, 28–31
gastric carcinoma 41, 165
gastric cardia see cardia
gastroesophageal junction 28, 91
anatomical relationships 167, 167–168, 168
aorta and 91, 167
longitudinal section 166, 166
oblque longitudinal scan 164
structures to left 168, 168
structures to right 168, 168
transverse sections 169, 169
Glisson’s triad 60
glomerulonephritis
acute 203, 203, 209, 209
chronic 210, 210
H
heart, liver relationship 88, 88–89, 89
heart failure
congestive 250, 273
findings 273
right-sided 24, 24
hemangiomia
atypical, of liver 56
liver see liver, hemangiomia
splenic 184, 184, 185
hematoma
infrarenal 57, 57
spleenic 185
subcapsular (renal) 207, 207
hematuria 282
hepatic artery
24, 24, 60, 82, 98, 98
aorta and 24
course 28, 28–32
longitudinal section 31, 31
normal 60
porta hepatis and 91, 96, 98, 98, 99, 100, 100, 101, 101
portal vein and 82
transverse section 32, 32
hepatic cysts 14, 55, 55
hepatic duct bifurcation 105, 105
see also common hepatic duct
hepatic veins 26, 26, 60, 60, 71, 71, 251
abnormalities 61, 61
demonstrating 26–27, 27
diameter 60
dilatation 61, 61, 254
gallbladder and 79
in hepatic cirrhosis 61
left 75
longitudinal sections 78, 78, 81
middle 77
longitudinal sections 79, 79, 81
narrowing 61, 61
normal 60
right 77
compression 55
longitudinal sections 80, 80, 81
transverse sections 74, 74
hepatic vessels 60, 60–62
chronic viral hepatitis 276
normal 60
see also hepatic artery; hepatic veins
hepatitis (viral)
acute 275
chronic 276
chronic hepatitis C 41
hepatocellular carcinoma (HCC) 57, 57
hepatomegaly 251
hepatorenal recess, ascites 95, 95
Hodgkin’s disease, spleen 183
horseshoe kidney 42, 42
hydrenephrosis 212, 212
causes 212
differential diagnosis 213, 213
grades 212, 212
hypercystic 202, 202, 209, 209
hypertension 273
hyperventilation 43
I
iliac arteries 24, 24
iliac veins 26, 26
iliac vessels 38–40
frontal view 38
longitudinal section 38, 40, 40
lymph node distribution 40
transverse section 38, 39, 39
image(s)
documentation 246–247
producing 12–13
quality 3, 4
impedance, acoustic 10, 12
“impedance mismatch” 12
 incidentaloma 235
infectious mononucleosis, splenic enlargement 182
inferior vena cava see vena cava
infundibular stones 121, 121
intercostal space
in gallbladder scans 109–110, 110
liver scans and 52, 52
interlobar fissure, liver 127, 127, 128, 128
intraperitoneal device 240
J
jaundice 274–275
K
kidney 191–229
abnormalities 199
access 207, 207
acute right-upper-quadrant pain 284
adrenal gland relationship 232, 232, 234, 234
age-related changes 203, 210
agenesis 199
angiohypertrophy 210, 210
angiomyolipoma 208, 208
aorta relationship 202
ascites and 216
boundaries 191–199
calculations 209, 209
colon relationship 214, 221, 221–222, 222
cortex 204, 204
corticomedullary junction 210, 210
cysts 206, 206, 207, 225
calcification 209, 209
hemorrhagic 209, 209
large 207
parapelvic 206, 207, 213, 213
pararenal 206
polycystic disease 208, 208
details 200–213
dimensions 200
dromedary hump 201, 201
duplex 211, 211
ectopic 199
enlargement 203, 203, 209, 209
gastric antrum and 215
glomerulonephritis
see glomerulonephritis
hematuria 282
hilar 36, 37, 204
horseshoe 42, 42, 202, 202
hydrenephrosis see hydrenephrosis
hypercystic 202, 202, 209, 209
in hypertension 273
large, chronic renal failure 283
left 36
anatomical relationships 226, 226–229
anatomy 197, 226

288

Block, Abdominal Ultrasound: Step by Step (ISBN 9783131383624), © 2012 Georg Thieme Verlag KG
barriers to scanning 197
colon relationship 226, 229, 229
duplication of collecting system 201
examination procedure 243
hilum 199
identification 197, 197
imaging in entirety 198, 198–199, 199
locating 197, 197
longitudinal flank scan 198, 198, 227, 227
psosas muscle relationship 226, 229
quadrate lumborum muscle and
reporting guidelines 243
scanning approach 192, 192
transverse flank scan 196, 196, 215, 217, 217, 220, 220, 225, 225
scanning approaches 193, 192, 192–193
scars 208, 208
shape 200
changes 201, 201
shrunken 203, 203
size, determining 200, 200
small 203, 203
chronic renal failure 283
sonographic anatomy 204, 204
spleen relationship 186, 187, 187–188, 188, 198, 199
stones 209, 213, 213
subcapsular hematoma 207, 207
transverse flank scan 209
see also entries beginning renal

L
lateral edge shadow 18, 18, 123
learning goals, of book 1
leukemia, chronic lymphoblastic 185
level-oriented scanning strategy 1
ligaments see individual ligaments
ligamentum teres 60, 60, 63, 63
fissure 67, 68
gallbladder and 64, 64, 67, 128
longitudinal section 65–66, 66, 67, 81
quadrate lobe scans 65, 65
transverse section 63–64, 64, 65, 65, 75, 76
ligamentum venosum 67–68, 68
fissure 67–68, 68
longitudinal sections 70, 70
lipomatosis, pancreatic 137, 142, 142
liver 43–95, 87
abscess 57, 57
acoustic window for stomach/duodenum 164
acute right-upper-quadrant pain 284
acute viral hepatitis 275
adenoma 56, 57
adrenal gland relationship 232, 232
alcoholic cirrhosis 46, 46
anatomical relationships 87, 87
central portion 90–92, 90–92
left portion 89, 89
longitudinal sections 89, 89, 91, 91
right portion 93, 93–94, 94
tangential scan 89, 89
transverse sections 89, 89, 91, 91
see also specific organs (under liver)
angle of inferior border 45, 45
anterior surface 45, 45
anterior view 62–63, 63
aorta relationship 28, 28
ascites and 95
barriers to scanning 43
blind spots 43, 48, 51
boundaries 43
inferior border 44–46, 45, 46, 46, 111
left border 48–49, 49, 88, 88
superior border 47, 47–48, 48
calcification 54, 54
simple 59, 59
carcinoma 57, 57
cardia relationship 91, 91
caudate lobe 62, 67–68, 68
fissure 67–70, 68, 69, 70
longitudinal section 70, 70
transverse sections 69, 69
center, transverse section 51, 51
central portion, relationships 90–92, 90–92
chronic viral hepatitis 276
cirrhosis see cirrhosis of liver
cystic 55, 55
cysts 14, 55, 55
details 53–86
duodenum relationship 93, 93–94, 94
enlarged 251
examination procedure 241
fatty 46, 46, 53, 54
focal nodular hyperplasia (FNH) 56, 57
focal sparing 57, 57
gallbladder and 44, 107
gallbladder relationship 93, 93–94, 94, 126–128, 126–128
gastric antrum and 92, 92, 172, 173
heart failure and 273
heart relationship 88, 88–89, 89
hemangioma 58, 58
atypical 56
calculated 59, 59
hematoma 57, 57
hepatic vessels see hepatic artery;
hepatic veins
identification 44
imaging in entirety 44–52
increased echogenicity 253
inferior border 44–46, 45
abnormalities/variants 46
angle 45, 45
gallbladder position and 111, 111
longitudinal scans 46, 46
inferior surface 126, 126
intercostal scans 50, 50, 52, 52
interlobar fissure and 127, 127, 128, 128
jaundice causes 275
left border 48–49, 49, 88, 88
trapezoidal shape 48–49, 49
left lobe 45, 62, 63
heart and stomach relationship 89, 89
pleural effusion and 190
superior border 47, 48
upper portion 67, 68
lobes 62–81
locating 43–44, 44
longitudinal scans 45, 47, 50, 50, 51
in lymphoma 272
mass
circumscribed 254
echo-free 255
hyperechoic 257
hyperechoic with acoustic
shadow 257
hypoechoic 256
isoechoic 257
metastases 54, 54, 55
highly echogenic 59, 59, 60
hyperechoic 59, 59
hypoechoic 56, 56
isoechoic 58, 58
normal echo pattern 53
normal variant 53, 54
optimization of scanning conditions 43
outlines 44–49
pancreas relationship 90, 90, 92, 92
pancreatic body 153, 153, 154, 154, 155, 155
parasitic cysts 55, 55
parenchymal pattern 53–60
abnormalities 53–60
circumscribed changes 54–60, 254
diffuse changes 53–54, 54
echo-free lesions 55, 55, 255
highly echogenic lesions 59, 59–60, 60
lymphoma

N
nephritis, acute 203, 203
nephrocalcinosis 209, 213, 213
nephropathy
analgesic 210, 210
diabetic 203, 203, 285
noise 14, 14
nomenclature, for findings 245
non-Hodgkin’s lymphoma 41, 42
spleen in
183, 234, 272
see also lymphoma

O
obesity
kidney scans 216
liver scans 44
nonvisualization of gallbladder 112, 112
pancreas scans 141
pancreas visualization problems 137
optimization of scanning conditions
gallbladder 107
kidney 193, 197
liver 43
pancreas 135
spleen 178
organ-oriented scanning strategy 1

P
pancreas
30, 135–163
abscess 143, 143
in acute pancreatitis 143, 143, 279–280
acute right-upper-quadrant pain 284
adrenal gland and 231
age-related changes 141
anatomical landmarks 136, 136, 138,
138, 139
anatomical relationships 149–163
anatomy 141
aorta and 136, 136, 137, 139
barriers to scanning 135
body 145
anatomical relationships 152–155,
152–155
diameter 148, 148
liver relationship 153, 153, 154, 154,
155, 155
longitudinal scans 155, 155
stomach relationship 153, 153, 154,
154, 155, 155
transverse scans 153, 153, 154, 154
boundaries 135–137
calcifications 142, 142
carcinoma see pancreatic carcinoma
celiac trunk and 136, 136, 137
in chronic pancreatitis 142, 142,
281–282
colon and 135
common bile duct 146–148, 147, 148
details 141–148
diameter, measurement 148, 148
dimensions 138, 148
duodenal relationship 160–163,
160–163
edematous swelling 143
examination procedure 244
f wasting before scans 135, 153
fibrolipomatosis 142, 142
gas obscuring 137
head 126, 126, 145
anatomical relationships 156–163
anatomy 156
carcinoma 144, 144, 146, 148
common bile duct course 146, 147
diameter 148, 148
duodenum relationship 160–163,
160–163
longitudinal scan 139, 139, 159, 159,
162, 163
portal vein relationship 157–159,
157–159
splenic vein relationship 157–159,
157–159
superior mesenteric vein relationship
157–159, 157–159
topography 156, 160
transverse scan 138, 158, 158, 161,
161, 162
vena cava relationship 157–159,
157–159
identification 136, 136
difficulties 137, 137
imaging in entirety 138–140
calculated echogenicity 267
left kidney relationship 226
lipomatosis 137, 142, 142
liver relationship 81, 80, 90, 90, 92,
92
locating 135, 135, 137
lymphoma 144, 144
normal 141, 142
obesity and 137, 141
parenchyma 141–144
abnormalities 142–144
portal vein relationship 157–159,
157–159
pseudocysts 143, 143, 280
pyloric antrum and 163
pylorus and 156
renal vessels and 140
reporting guidelines 244
salt-and-pepper pattern 142, 142
shape variations 140, 140
size 138, 148
spleen relationship 186, 187,
187–188, 188
splenic vein and 137, 138, 150, 151
course 149, 149
pancreatic head 157–159, 157–159
stomach relationship 153, 153, 154, 154,
155, 155
systematic analysis of findings 266–267
tail 41
anatomical relationships 149–151,
149–151
diameter 148, 148
longitudinal scan 139, 139, 151, 151
spleen relationship 150, 150
transplenic approach 140, 150, 150
transverse scan 138, 150, 150
upper abdominal longitudinal scans
139, 139, 139–140, 140
upper abdominal transverse scans
138, 138, 139
vena cava and 139, 157–159, 157–159, 163
visualization problems 137, 137, 267
pancreatic carcinoma 105, 144, 144
gallbladder enlargement 115
pancreatic duct 145–146, 265
abnormalities 146, 146
accessory 146
acute pancreatitis 280
chronic pancreatitis 281
dilatation 146, 266
dimensions 145
irregular walls 146
portal vein 31, 37
posterior acoustic enhancement 14, 183, 190
diaphragm and 204
lower abdomen 244
right kidney 243
reports 246
reverberations 14, 15
ribs, intercostal scan of liver 52, 52
Riedel’s lobe 46, 46
rocking movement 7, 7, 9
rotational movement 7, 7, 9

S
saccular aortic aneurysm 23, 23
scan planes, abdominal ultrasound 6, 6
scatter, sound 11
section-thickness (beam-width) artifact 15, 15, 123
seminal vesicles 236, 237
slab-lode artifact 16, 16
sliding on edge movement 7, 7, 8, 8
sliding on the flat movement 7, 7, 8, 8
small intestine
pancreas and 149
see also duodenum
sono consultant
clinical presentation 271–285
ultrasound findings 248–270
sound propagation 10–11
pulses 11, 12
velocity 12
spinal column 101
diaphragm and 177
left adrenal gland and 234
spleen 178–190
abnormalities 190, 190
abscesses 185
accessory 42, 42, 183, 183
calculi 275
adrenal gland relationship 234, 234
anatomical relationships 186, 186–190
ascites and 190, 190
barriers to screening 178, 186
during breathing 189, 189
calcifications 184, 184
chronic viral hepatitis 276
circumscribed changes 184, 268, 269
colic flexure relationship 186, 187, 187–188, 188
colon and 181, 187
donor 181, 187
constructions 181, 181
cysts 185
details 181–185
diffuse changes 183, 183
dimensions 182
echo-free lesions 185, 185, 268, 269
echo pattern 183–185
echogenic lesions 184, 184
enlarged 182, 182
focal changes 184, 184–185
gastric antrum and 187
hemangioma 184, 184, 185
hematoma 185
Hodgkin’s disease 183
hyperechoic changes 268, 270
hyperechoic changes with shadow 268, 270
Index

hypoechoic lesions 185, 185, 268, 269
identification 179
imaging in entirety 179, 179–180
impressions from other organs 181, 181
infarction 185
infectious mononucleosis 182
kidney relationship 186, 187, 187–188, 188, 198, 199, 226, 227, 227–228, 228
locating 178, 178–179
longitudinal flank scans 179, 179, 180, 182, 188
in lymphoma 183, 234, 272
metastases 184, 184
non-Hodgkin’s lymphoma 183, 234, 272
normal 182
pancreas relationship 186, 187, 187–188, 188
pancreatic tail relationship 150, 150
pleura relationship 189, 189
pleural effusion 190
renal impression 189
reporting guidelines 243
rupture 185
shape 181
size determination 182, 182–183
stomach relationship 186, 187, 187–188, 188
systematic analysis of findings 268–270
transverse flank sections 180, 180
splenic artery 24, 24
course 28, 28–31
longitudinal section 28, 28, 30, 30
porta hepatis scans 100, 100
transverse section 32, 32
splenic vein 30, 33, 33, 36, 188
anatomical relationships 33, 33
aorta and 102, 103
gallbladder and 129
longitudinal section 102, 102, 136
pancreas and 137, 138, 150, 151
course 149, 149
pancreatic head relationship 157–159, 157–159
porta hepatis scans 99, 100, 100, 101, 101
superior mesenteric vein and 102, 102
thrombosis 190
transverse section 33, 33–34, 103, 103
splenomegaly 182, 183, 271
in hepatic cirrhosis 61
staghorn calculus 213
stomach 164–177
anatomical relationships 166–171
antrum see gastric antrum
body 170, 170–171
filling with fluid 132, 135, 171, 171
longitudinal sections 170, 170
transverse sections 171, 171
boundaries 166–171
carcinoma 41, 165
cardia see cardia
details 165
esophageal junction see gastroesophageal
junction
left kidney relationship 226
liver relationship
central portion 90–92, 90–92
left portion 88, 88–89, 89
pancreas relationship, pancreatic body
153, 153, 154, 154, 155, 155
pancreas relationship, pancreatic body
153, 153, 154, 154, 155, 155
porta hepatis and 101
pyloric antrum see gastric antrum;
pyloric antrum
pylorus see pylorus
scan plans 166
spleen relationship 186, 187, 187–188, 188
wall 165, 165
changes 165, 165
hypoechoic 145
subphrenic space, ascites 95, 95
superior mesenteric artery 21, 24, 24, 33, 33–34
anatomical relationships 33, 33
demonstrating 25, 25
longitudinal section 102, 102
portal vein and 102, 102
renal vessels and 35, 35, 37
transverse section 33, 33–34, 34, 136
superior mesenteric vein 156
gallbladder and 129, 133
longitudinal section 102, 102
pancreatic head relationship 157–159,
157–159
splenic vein and 102, 102
transverse section 103, 103
symphysis pubis 236, 236, 238
systematic ultrasound examination
241–247
T
thrombosis
partial, of aortic aneurysm 23, 23
vena cava 24, 24
tilting (angling) movement 7, 7, 9, 9
time-gain compensation 3
tissue density 12
tissues, ultrasound propagation in 11–12
transducers 3–4
curved array 3, 4
designs 3
linear 3, 3
mechanism of action 11
movements 7, 7–9, 8, 9
position 4–6
sector 3, 3
selector switch 3
transverse section 4, 4
tumors see carcinoma; specific tumors
U
ultrasound
acoustics 10–12
artifacts see artifacts
definitions 10
image production 12–13
principles 3, 10–18
production/detection 11
propagation in tissues 11–12
ultrasound machine
2, 2–3
adjusting method 2, 2–3
control panel 2, 2–3
ultrasound system 2
umbilical vein 66
upper abdominal longitudinal scans 192
gallbladder 109, 109, 129, 129
left adrenal gland 234, 234
pancreas 137, 139, 139–140, 140
right adrenal gland 232, 232
see also specific organs
upper abdominal transverse scans 192
gallbladder 108, 108, 125, 129
left adrenal gland 234, 234
pancreas 138, 138
right adrenal gland 233, 233
see also specific organs
ureters 282
proximal 211
urothelial carcinoma, liver metastases 55
uterus
anteflexed 240
bladder and 238, 238–239, 239
details 240
V
vagina 238, 238, 239
veins see individual veins
vena cava 20–21, 68
adrenal glands and 232, 233
anatomical relationships 28–32
artefacts 16
bifurcation 38
bowel gas obscuring 20, 20, 21, 21
breathing and 22, 22
cardia and 28, 28
common bile duct and 147
compressibility 24
diameter 22, 24
diaphragm and 28, 28, 176, 176, 177
dilatation 250
duodenum and 174, 175
desophagus and 167, 168
gallbladder and 107, 107, 109, 109, 132, 133, 134
gastric antrum and 174, 175
heart failure and 24, 24, 273
hepatic artery and 31
hepatic veins and 73, 73, 79, 80
liver relationship 90–92, 90–92, 94
caudate lobe and 70, 70
locating 19, 19–20
longitudinal section 20, 20–21, 22, 22, 27
lumen abnormalities 24
lymph node distribution 40, 41, 42
organ boundaries 19, 19–20
pancreas and 139, 163
pancreatic head relationship 156,
157–159, 157–159
porta hepatis and 96, 96, 97, 97, 100, 100,
101, 101, 102
portal vein and 82, 82, 85, 102, 102,
103, 103
pulsation 22–24
renal vessels and 35, 35, 37
systematic analysis of findings 250
thrombosis 24, 24
transverse section 20, 20, 27
tributaries 26, 26–27
wall 22, 22
abnormalities 24
venous pulsation 22, 22–24
ventricle 33
Preface to the Second Edition

The first edition was published in 2004 as *The Practice of Ultrasound*. My goal at that time was to walk the user through the basic principles of upper abdominal ultrasound scanning. I am pleased that this concept is being revived and that a second edition of the book can now be published. Once again the author recommends keeping the book close at hand during the ultrasound examination.

The closing chapter of this edition serves as a "Sono Consultant." It has been designed to provide systematic guidance in interpreting suspicious findings and determining how ultrasound can be applied to specific clinical questions.

Several of my colleagues supplied me with valuable ultrasound images for inclusion in the previous edition. For the current edition I am particularly indebted to Dr. Johannes Linder, who has again provided me with high-quality images drawn from his clinical practice.

I wish my readers success in learning this modality and hope that they enjoy the practice of abdominal ultrasound scanning.

*Berthold Block, Braunschweig, Germany*