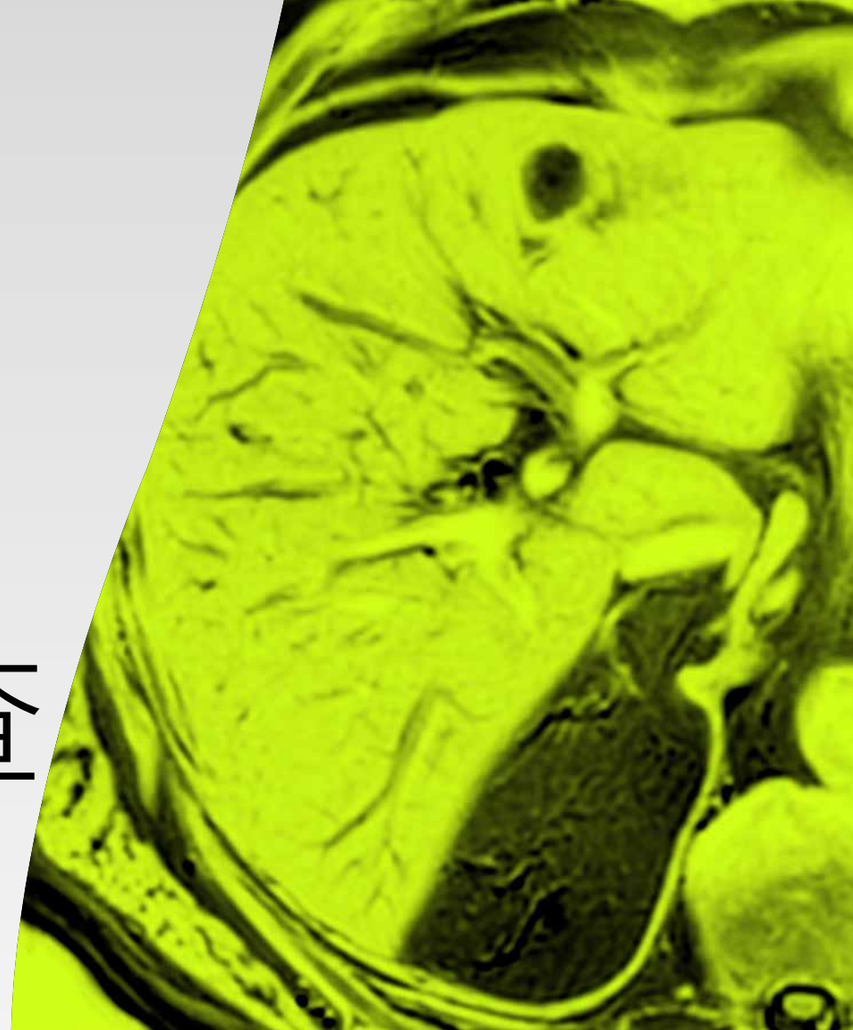
MODERN RADIOLOGY eBook

Liver Imaging

肝脏影像学检查



EUROPEAN SOCIETY OF RADIOLOGY

Preface

Modern Radiology is a free educational resource for radiology published online by the European Society of Radiology (ESR). The title of this second, rebranded version reflects the novel didactic concept of the ***ESR eBook*** with its unique blend of text, images, and schematics in the form of succinct pages, supplemented by clinical imaging cases, Q&A sections and hyperlinks allowing to switch quickly between the different sections of organ-based and more technical chapters, summaries and references.

Its chapters are based on the contributions of over 100 recognised European experts, referring to both general technical and organ-based clinical imaging topics. The new graphical look showing Asklepios with fashionable glasses, symbolises the combination of classical medical teaching with contemporary style education.

Although the initial version of the ***ESR eBook*** was created to provide basic knowledge for medical students and teachers of undergraduate courses, it has gradually expanded its scope to include more advanced knowledge for readers who wish to 'dig deeper'. As a result, *Modern Radiology* covers also topics of the postgraduate levels of the *European Training Curriculum for Radiology*, thus addressing postgraduate educational needs of residents. In addition, it reflects feedback from medical professionals worldwide who wish to update their knowledge in specific areas of medical imaging and who have already appreciated the depth and clarity of the ***ESR eBook*** across the basic and more advanced educational levels.

I would like to express my heartfelt thanks to all authors who contributed their time and expertise to this voluntary, non-profit endeavour as well as Carlo Catalano, Andrea Laghi and András Palkó, who had the initial idea to create an ***ESR eBook***, and - finally - to the ESR Office for their technical and administrative support.

Modern Radiology embodies a collaborative spirit and unwavering commitment to this fascinating medical discipline which is indispensable for modern patient care. I hope that this ***educational*** tool may encourage curiosity and critical thinking, contributing to the appreciation of the art and science of radiology across Europe and beyond.

Minerva Becker, Editor
Professor of Radiology, University of Geneva, Switzerland

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前言

章节大纲：

《*现代放射学*》是由欧洲放射学协会 (European Society of Radiology, ESR) 在线发布的免费放射学教育资源。第二版（更名版）标题反映了 ***ESR 电子书***新颖的教学概念，它以简洁页面的形式巧妙地融合文本、图像和示意图，并辅以临床影像学案例、问答部分和内容超链接，使读者能够在各基于器官的部分、更具技术性的章节、摘要以及参考文献之间快速切换浏览。

其章节以 100 多名公认欧洲专家的优秀稿件为根基，涉及各类一般技术和基于器官的临床影像学主题。同时采用了全新的图形外观，展示了佩戴时尚眼镜的 Asklepios，象征着传统医学教学与现代风格教育的结合。

虽然初版 ***ESR 电子书***旨在为医学生和本科生教师提供医学基础知识，但现已逐渐扩充其知识领域，为希望“深入挖掘”的读者提供了更多高阶技术知识。因此，《*现代放射学*》还涵盖了*欧洲放射学培训课程*研究生水平的各类主题，旨在解决住院医师的研究生教育需求。此外，书中还囊括了全球医疗专业人士的反馈，他们希望更新自己在医学影像特定领域的知识，并对 ***ESR 电子书***在基础和高等教育水平上的深度和清晰度表示高度赞赏。

我要衷心感谢所有为这项非营利活动自愿贡献时间和专业知识的作者，以及最初提出创作 ***ESR 电子书***的 Carlo Catalano、Andrea Laghi 和 András Palkó，最后还要感谢 ESR 办公室所提供的技术和行政支持。

《*现代放射学*》充分体现了医者的协作精神和对这门热门医学学科坚定不移的承诺，这是现代患者护理必须具备的优秀精神品质。我希望这款***教育***工具能够激励各位始终保持好奇心和批判性思维，从而促进整个欧洲乃至欧洲以外地区对放射学艺术和科学的认识。

Minerva Becker，编辑
瑞士日内瓦大学放射学教授

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How to cite this work:

European Society of Radiology, András Palkó (2024)
ESR Modern Radiology eBook:

Liver Imaging.
DOI 10.26044/esr-modern-radiology-17

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章节大纲：

本作品引用方式：

European Society of Radiology, András Palkó (2024)
ESR Modern Radiology eBook:

Liver Imaging.
DOI 10.26044/esr-modern-radiology-17

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This is a translation of the Chapter of the **Modern Radiology eBook.**

ORIGINAL TITLE:
Liver Imaging

TRANSLATED BY:
Prof. Bin Song, West China Hospital of Sichuan University
Prof. Chuanmiao Xie, Sun Yat-sen University Cancer Center

COORDINATED BY:
Prof. Shiyuan Liu, Shanghai Changzheng Hospital
Prof. Yi Xiao, Shanghai Changzheng Hospital

ENDORSED BY:
Chinese Society of Radiology

NOTE FROM THE COORDINATORS:
Thank you to Chinese radiology experts for bridging languages and open the world-class English resource by ESR to every Mandarin-speaking student, fueling global radiology talent with a single click

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anicesong@vip.sina.com
xiechm@sysucc.org.cn

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翻译致谢

肝脏影像学检查

本章节为《现代放射学电子书》的部分译文。

原文标题：
肝脏影像学检查

翻译：
宋彬教授，四川大学华西医院
谢传淼教授，中山大学肿瘤防治中心

联合翻译：
刘士远教授，长征医院
萧毅教授，长征医院

审定：
中华医学会放射学分会

译者寄语：
感谢中国放射学专家们的倾力奉献！你们跨越了语言的鸿沟，将欧洲放射学会 (ESR) 的世界级学术宝库呈献给广大中文学子。如今，前沿智慧一键即达，为全球放射学人才的蓬勃发展注入了强劲动力。

<↑> 超链接

anicesong@vip.sina.com
xiechm@sysucc.org.cn

/ Signage

<▪> CORE KNOWLEDGE

<!> ATTENTION

<↑> HYPERLINKS

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<?> 问题

MODERN RADIOLOGY eBook

Based on the ESR Curriculum for Radiological Education

Liver Imaging

AUTHORS

András Palkó

AFFILIATION

University of Szeged, Hungary

Liver Imaging

CHAPTER OUTLINE:

<↑> HYPERLINK

palkoand@gmail.com

基于 ESR 课程的放射学教育

肝脏影像学检查

章节大纲：

肝脏影像学检查

作者

András Palkó

所属机构

University of Szeged，Hungary

<↑> 超链接

palkoand@gmail.com

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  - Blood Supply
  - Biliary Excretion
  - Sinusoids
  - Normal US-, CT- and MRI-Anatomy
- Strengths, Weaknesses and Role of Imaging Modalities
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Anatomy

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章节大纲：

解剖结构

/ The Normal Liver

For general anatomical, histological and physiological information please refer to your knowledge obtained during your respective studies in the previous years.

We herewith provide only some imaging-specific additions to the subject (Figs. 1- 8).

<!> ATTENTION

For liver anatomy as seen at imaging, please also see the eBook chapters on Bile Ducts & Computed Tomography!

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/ 正常肝脏

章节大纲：

有关一般解剖学、组织学和生理学信息，请参考您在既往学习阶段所掌握的相关知识。

本书仅提供与本主题相关的影像学补充内容（图1-8）。

<!> 注意

如需了解影像学所示的肝脏解剖结构，另请参阅《胆管》与《计算机断层扫描》电子书章节!

<!> ATTENTION

The liver has a dual blood supply (Fig. 1): the majority of the blood arrives from the portal vein (75%), while the rest (25%) is provided by the hepatic artery.

The **portal vein blood** is oxygen-poor and nutrient-rich as it carries the blood from the gastrointestinal tract and spleen while the **blood from the hepatic arteries** (which supplies the biliary system) is oxygen-rich and nutrient poor.

The **venous liver drainage** takes place via the three hepatic veins (right, middle and left) into the inferior vena cava (**Fig. 1**).

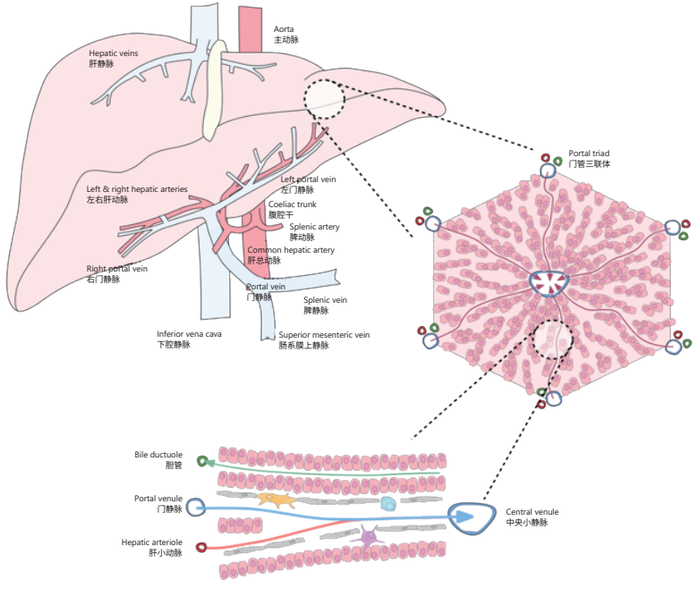

FIGURE 1

Diagram of the dual blood supply of the liver, the liver lobule, the portal tract and their inter-relations. Image reproduced from: https://en.wikipedia.org/wiki/Liver

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<!> 注意

肝脏具有双重血供（图 1）：大部分血液来自门静脉 (75%)，其余来自肝动脉 (25%)。

门静脉血含氧量较低但富含营养物质，因其携带来自胃肠道及脾脏的血液，而肝动脉血（负责供应胆道系统）含氧量较高但营养物质较少。

肝静脉引流通过三条肝静脉（右、中和左）汇入下腔静脉（图 1）。

图 1

肝脏、肝小叶、门管区的双重血供及其相互关系示意图。影像来源：https://en.wikipedia.org/wiki/Liver

According to the Couinaud classification, the liver is divided into **8 segments** (Fig. 2). Each segment is a functional unit which can be resected separately at surgery. Each segment is supplied by individual hepatic arteries, portal veins and bile ducts.

>■< FURTHER KNOWLEDGE

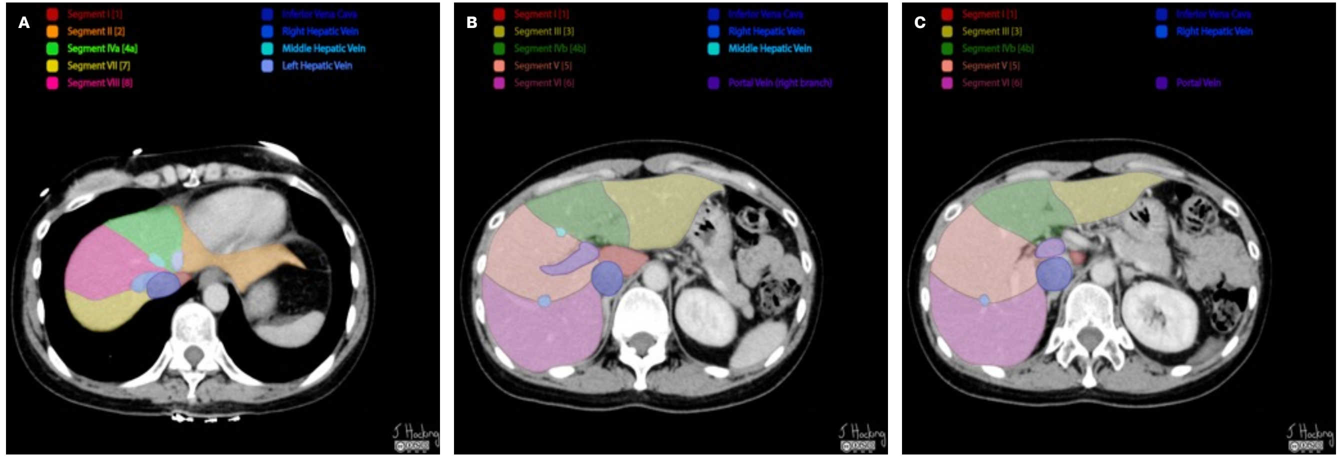

FIGURE 2

Liver segments as seen on three axial CT images (**A**, **B** and **C**).
Case courtesy of Jeffrey Hocking, Radiopaedia.org, rID: 45972

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根据 Couinaud 分段法，肝脏被分为 **8 段**（图 2）。每个肝段都是一个功能单位，手术中可单独切除。每个肝段均由独立的肝动脉、门静脉及胆管供给。

章节大纲：

>■< 进阶知识

图 2

三张轴位 CT 图像上显示的肝段（A、B 和 C）。
病例来源：Jeffrey Hocking，Radiopaedia.org，rID：45972

Ultrasonography (US) is an excellent first-line examination tool to image the liver (Fig. 3).

The role of US consists in assessing the size, parenchymal echogenicity, capsular contour, vascularity, the biliary tree, liver masses or fluid collections.

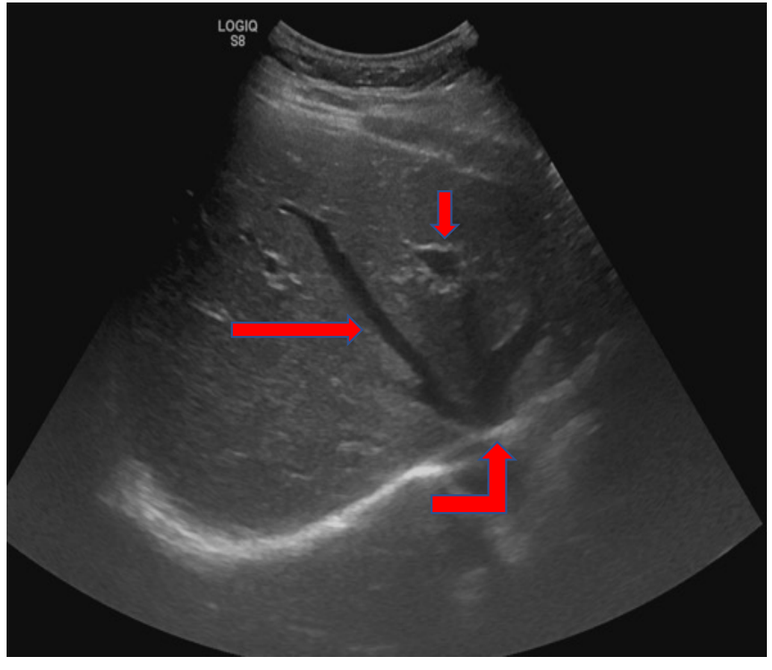

FIGURE 3

Normal liver US. Oblique axial scan through segments 4, 8 and 7 show normal parenchyma and vascular structures. Portal vein (**short arrow**), right hepatic vein (**long arrow**), Inferior vena cava (**upwards arrow with tip rightwards**).

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超声检查 (US) 是肝脏影像学检查的优质一线工具（图 3）。

US 的作用包括评估肝脏大小、实质回声、包膜轮廓、血管结构、胆道系统、肝脏肿块或积液。

图 3

正常肝脏 US 表现。覆盖第 4、8 和 7 肝段的斜轴位扫描显示肝实质及血管结构正常。门静脉（短箭头）、肝右静脉（长箭头）、下腔静脉（尖端向右的向上箭头）。

On MRI, the normal liver has a uniform signal intensity that is higher than the signal intensity of the spleen on T1- and lower on T2-weighted images (Fig. 4). Vessels usually have a low signal due to flow-related signal loss. MRI has the highest sensitivity and specificity for liver lesions in comparison to all other imaging techniques.

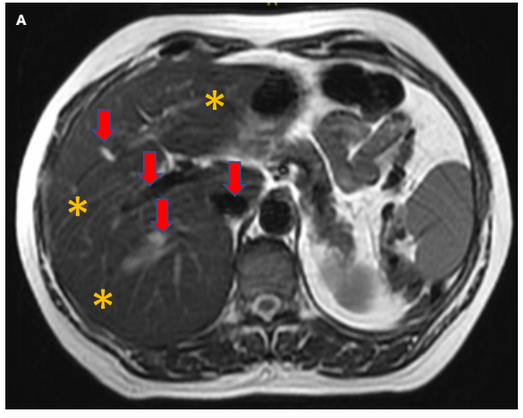

FIGURE 4

A, B normal liver MRI. Axial T2-weighted (**A**) and T1 postcontrast (**B**) scans at the level of the liver hilum show normal parenchyma (**asterisks**) and vessels (**arrows**).

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在 MRI 上，正常肝脏呈均匀信号强度，在 T1 加权图像上信号强度高于脾脏，在 T2 加权图像上信号强度低于脾脏（图 4）。由于血流相关信号损失，血管通常表现为低信号。相较于其他影像学检查技术，MRI 对肝脏病变的敏感性和特异性最高。

章节大纲：

图 4

A、B 正常肝脏 MRI。肝门水平轴位 T2 加权 (**A**) 和 T1 增强后 (**B**) 扫描显示正常实质（星号）和血管（箭头）。

/ Dual Blood Supply

Because of the dual blood supply, if multiphasic contrast-enhanced US-, CT- or MRI-examinations are performed, several phases of contrast enhancement can be distinguished. These are:

- **Arterial** phase (about 20 sec post injection for optimal enhancement of structures directly supplied by the arterial system): lesions with arterial blood supply enhance intensively but note that arterial supply is not necessarily equivalent to hypervascularity
- **Portal** venous phase also known as the late portal or hepatic phase (approximately 60 sec post injection): normal liver parenchyma and lesions of portal blood supply are enhanced and branches of the portal and hepatic veins are best delineated
- **Delayed** phase (about 2-3 min post injection): lesions with slow perfusion show enhancement

<!> ATTENTION

The acquisition time for each phase depends on several factors:

- Type of intravenous device used (central or peripheral catheter)
- Contrast medium concentration (see chapter on contrast media)
- Injection rate

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/ 双重血供

章节大纲：

由于存在双重血供，若进行多期超声造影、CT 或 MRI 检查，可区分不同对比增强期。分别是：

- **动脉**期（注射后约 20 s，此时直接由动脉系统供血的结构可实现最佳强化）：由动脉供血的病变会出现显著强化，但需注意，动脉供血并不等同于富血供
- **门静脉**期也称为晚门静脉期或肝实质期（注射后约 60 s）：正常肝实质及由门静脉供血的病变会呈现强化，且门静脉与肝静脉分支在此期显示最清晰
- **延迟**期（注射后约 2-3 min）：血流灌注缓慢的病变在此期呈现强化

<!> 注意

每个阶段的采集时间取决于多种因素：

- 静脉穿刺装置类型（中心静脉导管或外周静脉导管）
- 对比剂浓度（参阅对比剂章节）
- 注射速率

After injection of an intravenous contrast material, in the arterial phase, there is opacification of the hepatic artery and its branches, whereas in the portal venous phase, the portal vein is opacified (Figs. 5 and 6). Liver parenchyma enhances most in the parenchymal phase.

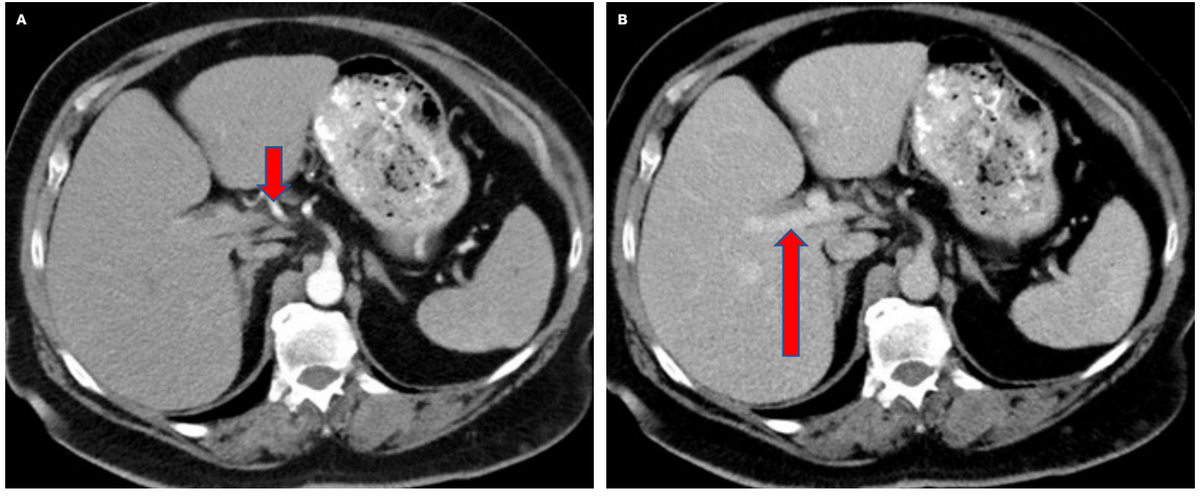

FIGURE 5

Normal liver CT. Arterial phase postcontrast (**A**) and portal phase postcontrast (**B**) scans at the level of the liver hilum show homogeneous parenchyma and normal vessels. Hepatic artery (**short arrow**), portal vein (**long arrow**).

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静脉注射对比剂后，动脉期可见肝动脉及其分支显影；门静脉期则表现为门静脉显影（图5 和 6）。肝实质在实质期强化最为显著。

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图 5

正常肝脏 CT 表现。肝门水平动脉期增强后 (**A**) 和门静脉期增强后 (**B**) 扫描显示肝实质均匀，血管形态正常。肝动脉（**短箭头**）、门静脉（**长箭头**）。

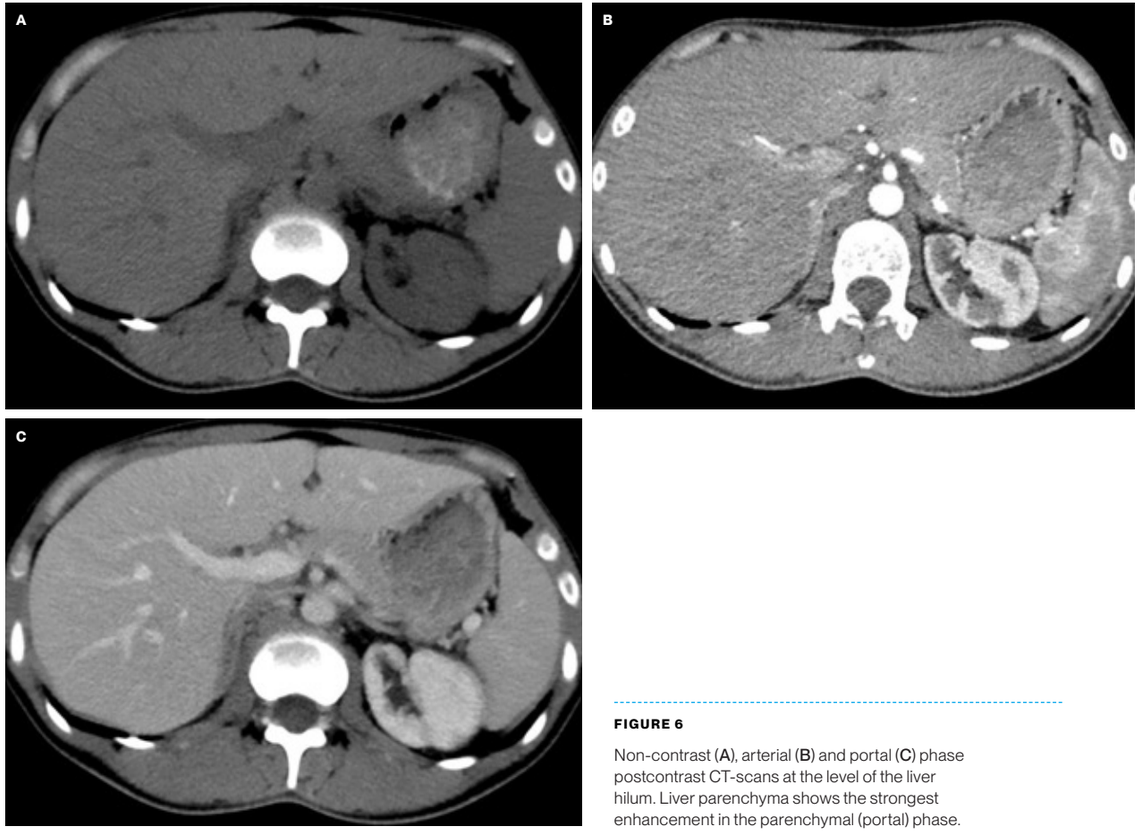

FIGURE 6

Non-contrast (**A**), arterial (**B**) and portal (**C**) phase postcontrast CT-scans at the level of the liver hilum. Liver parenchyma shows the strongest enhancement in the parenchymal (portal) phase.

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图 6

肝门水平非增强 (**A**)、动脉期增强 (**B**) 和门静脉期 (**C**) 增强影像。肝实质在实质（门静脉）期强化最明显。

/ Biliary Excretion

<!> ATTENTION

Active membrane transport in hepatocytes plays a key role in biliary excretion. If MRI (Gd-based) contrast media are bound to proper carrier molecules, excretion through the same pathways takes place (**hepatobiliary contrast agents**). In consequence, significant contrast enhancement is seen in **normal liver parenchyma (Fig. 7)**, whereas lesions without normal hepatocytes do not show normal biliary excretion.

<∞> REFERENCE

Inchingolo R et al, Eur Radiol 2014, DOI 10.1007/s00330-014-3500-7

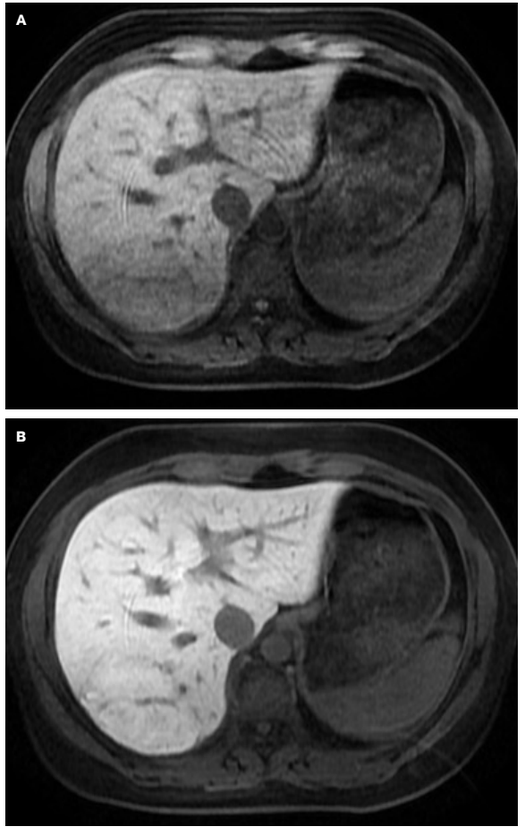

FIGURE 7

Non-contrast (**A**) and hepatobiliary contrast-enhanced (**B**) phase of a liver MRI: the contrast material accumulates in normal hepatocytes which results in an increase in signal intensity in B.

See also eBook chapter on Contrast Media!

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章节大纲：

<!> 注意

肝细胞的主动膜转运在胆汁排泄中起关键作用。如果MRI（含钆）对比剂与适当载体分子结合，则可通过相同的途径排泄（**肝胆对比剂**）。因此，**正常肝实质**呈显著强化（图 7），而缺乏正常肝细胞的病变则不显示正常胆汁排泄。

<∞> 参考文献

Inchingolo R et al, Eur Radiol 2014, DOI 10.1007/s00330-014-3500-7

图 7

肝脏 MRI 的非增强 (**A**) 期与肝胆期增强 (**B**) 影像：对比剂在正常肝细胞中蓄积，导致 B 中的信号强度增加。

另请参阅《对比剂》电子书章节！

/ Sinusoids

Special liver capillaries called sinusoids (common end-branches of the portal venous and the hepatic arterial circulation) serve for mixing the oxygen-rich hepatic arterial blood with the nutrient-rich portal vein blood.

Their lining contains **liver sinusoidal endothelial cells (LSEC)** and **Kupffer cells** (macrophages with a scavenging function, belonging to the reticuloendothelial system). LSEC have fenestrations, which allow communication between the sinusoids and the **space of Disse**. The space of Disse separates hepatocytes from sinusoids (**Fig. 8 and 9**) .

If **RES-specific contrast agents** are used, normal liver parenchyma will enhance due to selective accumulation of these contrast agents in Kupffer cells, while in areas without normal sinusoids no no enhancement is seen.

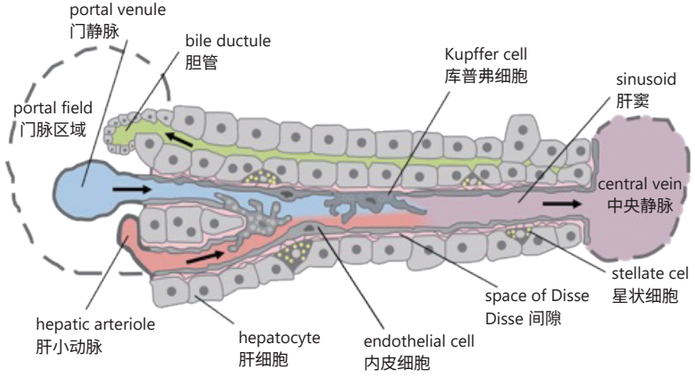


FIGURE 8

Schematic illustration of the liver sinusoid (see explanation in the text). Figure based on the research article by Frevert U, Engelmann S, Zougbédé S, Stange J, Ng B, et al. "Intravital Observation of Plasmodium berghei Sporozoite Infection of the Liver", PLoS Biology, doi:10.1371/journal.pbio.0030192.g011

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏影像学检查

/ 肝窦

章节大纲：

肝脏特殊毛细血管称为肝窦（门静脉与肝动脉循环的共同终末分支），其作用是将富氧的肝动脉血与富营养的门静脉血混合。

肝窦内衬由**肝窦内皮细胞 (LSEC)** 和 **Kupffer 细胞**构成（具有吞噬功能的巨噬细胞，属于网状内皮系统）。LSEC 具有窗孔结构，可使肝窦与 **Disse 间隙**之间进行物质交换。Disse 间隙将肝细胞与肝窦分隔开（**图 8 和 9**）。

若使用 **RES 特异性对比剂**，由于这些对比剂会选择性聚集于 Kupffer 细胞，正常肝实质会出现强化；而在无正常肝窦的区域则无强化表现。

图 8

肝窦示意图（具体说明见正文）。图片源自研究文章：Frevert U, Engelmann S, Zougbédé S, Stange J, Ng B, et al. "Intravital Observation of Plasmodium berghei Sporozoite Infection of the Liver", PLoS Biology, doi:10.1371/journal.pbio.0030192.g011

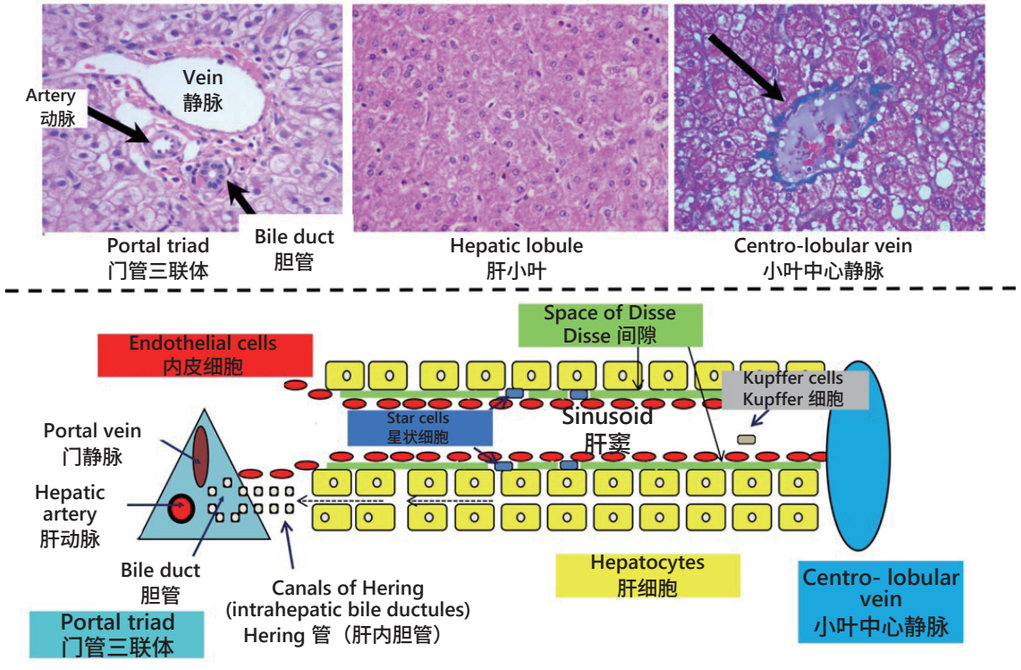


FIGURE 9

Schematic illustration including histology of the hepatic lobules, portal triads and liver sinusoids. Figure courtesy of Prof. Laura Rubbia Brandt, MD, Diagnostic Department, Geneva University Hospitals.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

图 9

肝小叶、门管区及肝窦的组织学示意图。图片来源：Laura Rubbia Brandt 教授，医学博士，Diagnostic Department，Geneva University Hospitals。

Strengths, Weaknesses and Role of Imaging Modalities

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

影像学检查方法的优势、劣势和作用

/ X-Ray Examinations

<!> ATTENTION

X-ray examinations **do not play any role** in the evaluation of the liver, because liver X-ray absorption is homogeneous and very similar to that of the surrounding organs.

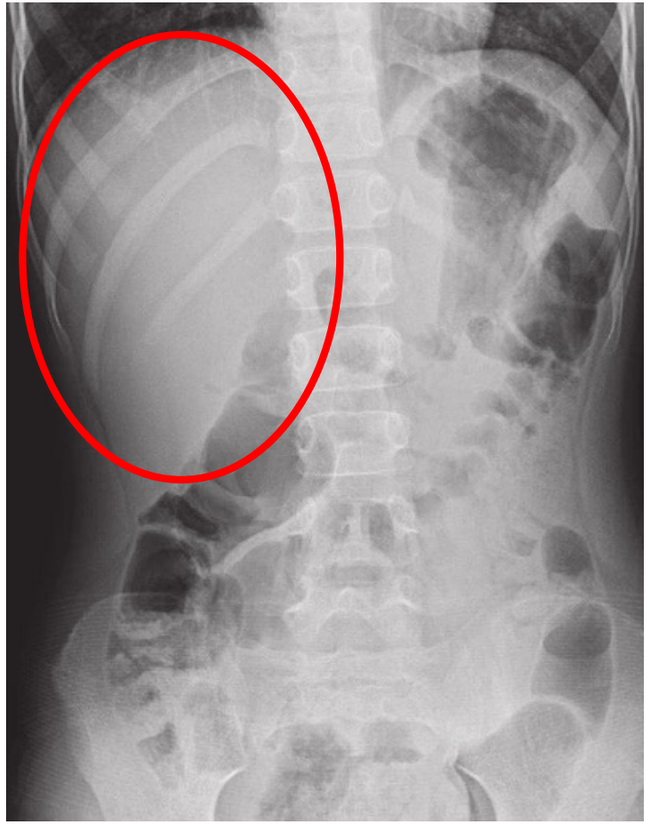


FIGURE 10

Normal plain abdominal X-ray demonstrating the gasless area corresponding with the liver in the right upper quadrant.

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

/ X 线检查

章节大纲：

<!> 注意

X 线检查在肝脏评估中无实际作用，因肝脏对 X 线吸收均匀，且与周围器官的 X 线吸收水平高度相似。

图 10

正常腹部 X 线平片，显示右上腹肝脏对应的无气体区。

/ Ultrasound

<!> ATTENTION

Ultrasound (US) is the first-line imaging examination for liver lesions.

On B-mode US scans, liver parenchyma, portal and hepatic venous branches are easily depicted (Fig. 11) while normal intrahepatic arteries and intrahepatic bile ducts are not visible.

Doppler-ultrasound (Doppler-US) provides information regarding liver circulation, whereas US elastography provides information regarding parenchyma elasticity.

Information about vascularity of focal lesions can be acquired by contrast-enhanced ultrasound (CEUS).

<!> ATTENTION

US examinations are often diagnostic, however, further examinations may be necessary to exclude or confirm the presence/absence of focal lesions, define their number and characterise them.

<∞> REFERENCES

Aparna Srinivasa Babu et al, RadioGraphics 2016; 36:1987–2006
Burrowes DP et al, RadioGraphics 2017; 37:1388–1400

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

章节大纲：

/ 超声

<!> 注意

超声 (US) 是肝脏病变的一线影像学检查手段。

在 B 型 US 扫描中，肝实质、门静脉及肝静脉分支清晰可辨（图 11），而正常肝内动脉及肝内胆管则不可见。

多普勒超声 (Doppler-US) 可提供肝脏血流循环信息，而 US 弹性成像可提供肝实质弹性信息。

超声造影（contrast-enhanced ultrasound，CEUS）可提供局灶性病变的血供信息。

<!> 注意

US 检查通常可明确诊断，但有时仍需进一步检查以排除或确认局灶性病变的存在，明确其数量及特征。

<∞> 参考文献

Aparna Srinivasa Babu et al, RadioGraphics 2016; 36:1987–2006
Burrowes DP et al, RadioGraphics 2017; 37:1388–1400

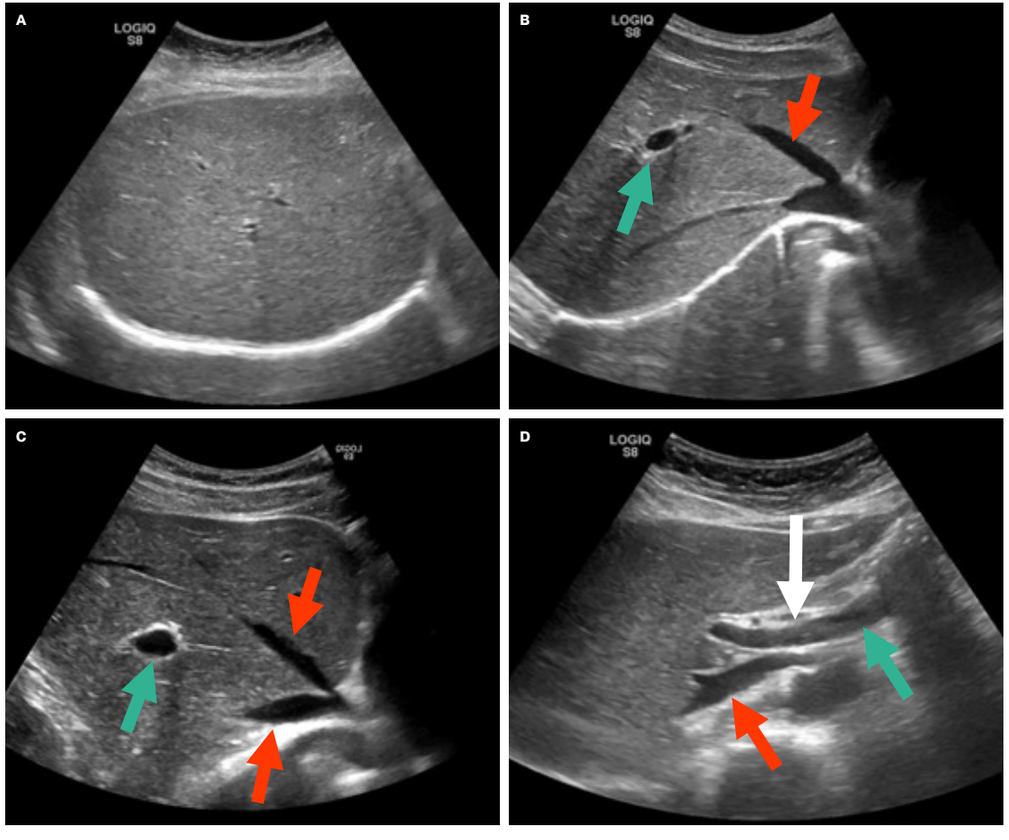


FIGURE 11

Normal US (B-mode) showing normal homogenous liver echo structure and vessels in the liver. Hepatic veins are indicated by red arrows, portal vein branches by green arrows and the hepatic artery by a white arrow.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

图 11

正常 US（B 型）图像显示肝实质回声均匀，肝内血管清晰可见。肝静脉用红色箭头表示，门静脉分支用绿色箭头表示，肝动脉用白色箭头表示。

/ Computed Tomography

Computed tomography (CT) is always performed using a multiphasic contrast-enhanced technique (pre-contrast + arterial + portal and, if necessary, delayed phase).

Normal liver parenchyma is of homogenous density with a peak enhancement in the portal phase, the blood vessels are clearly visible, while the normal intrahepatic bile ducts are not delineated (**Fig. 12**).

<!> ATTENTION

CT may help to recognise **diffuse changes** in liver density (fat, iron deposition, etc).

It can also detect and characterise lesions, that are not well depicted by US based on their distinctive absorption and enhancement patterns.

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

/ 计算机断层扫描

章节大纲：

计算机断层扫描 (CT) 通常采用多期对比增强技术（增强前 + 动脉期 + 门静脉期，必要时加做延迟期）。

正常肝实质密度均匀，在门静脉期达强化峰值，血管清晰可见，而正常肝内胆管不可辨（图 12）。

<!> 注意

CT 可帮助识别肝脏密度的弥漫性改变（脂肪、铁沉积等），

并可根据病变的特征性吸收及强化模式，定位和定性 US 显示不佳的病变。

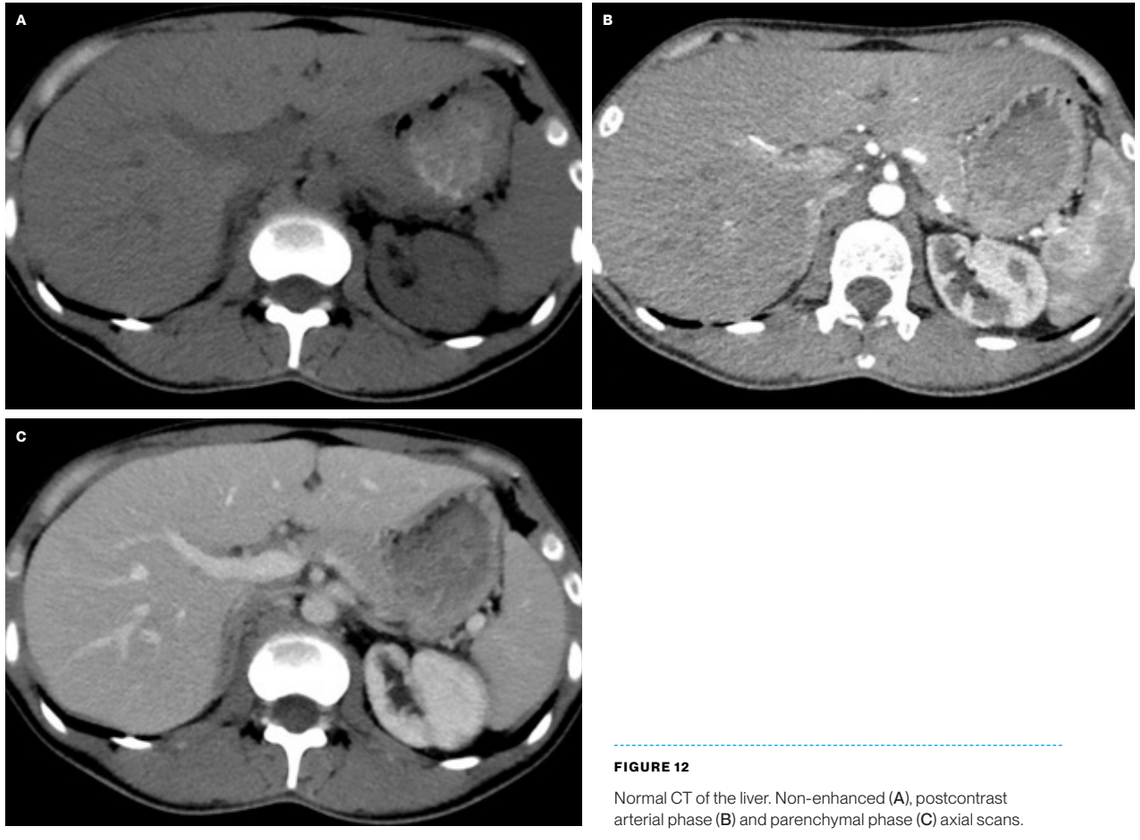


FIGURE 12

Normal CT of the liver. Non-enhanced (**A**), postcontrast arterial phase (**B**) and parenchymal phase (**C**) axial scans.

Liver Imaging

CHAPTER OUTLINE:

肝脏 影像学检查

章节大纲：

图 12

正常肝脏 CT 图像。非增强 (**A**)、增强后动脉期 (**B**) 和实质期 (**C**) 轴位扫描。

/ Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) is the most reliable and accurate test for the evaluation of the liver. Normal liver parenchyma is homogeneous (**Figs. 13 and 14**), and – depending on the used sequence – blood vessels and bile ducts can be easily identified.

Using special contrast materials (see chapter on Contrast Media) it is also possible to evaluate the presence/absence of hepatobiliary excretion, thus better detecting and characterising focal lesions .

MR-elastography gives information about the elasticity of liver parenchyma and of focal liver lesions.

<!> ATTENTION

Multiphasic contrast-enhanced sequences play the same role as in CT. However, MRI has many advantages:

- **Fat-sensitive MRI sequences (Fig. 14)** allow the evaluation of parenchymal fat content (steatosis)
- **Diffusion-weighted sequences** improve the detection and characterisation of certain focal lesions
- Sequences for the **semiquantitative evaluation of metallic content** allow improved lesion detection and characterisation

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏影像学检查

/ 磁共振成像

磁共振成像 (MRI) 是评估肝脏最可靠、最精准的检查方法。正常肝实质呈均匀信号（**图13 和 14**），根据所采用的扫描序列不同，血管及胆管可清晰辨识。

通过使用特殊对比剂（参阅对比剂章节），还可评估肝脏是否存在肝胆排泄，从而更精准地定位和定性局灶性病变。

MR 弹性成像可提供肝实质及肝局灶性病变的弹性信息。

<!> 注意

多期对比增强序列的作用与 CT 相同。但 MRI 具有多种优势：

- **脂肪敏感 MRI 序列**（图 14）可评估肝实质脂肪含量（脂肪变性）
- **弥散加权序列**可改善某些局灶性病变的定位和定性
- **金属含量半定量评估序列**可改善病变的定位和定性能力

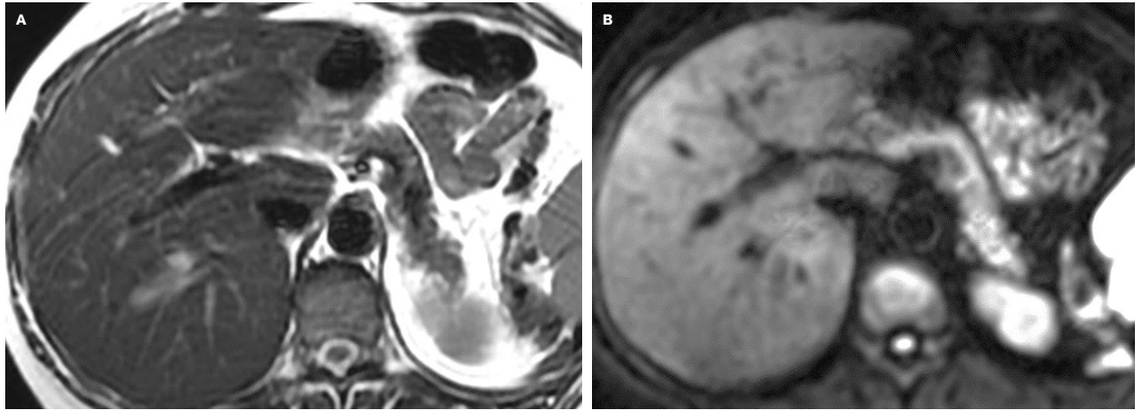


FIGURE 13

Normal MRI of the liver with T2-weighted (**A**) and diffusion-weighted (**B**) sequences.

Liver Imaging

CHAPTER OUTLINE:

肝脏 影像学检查

章节大纲：

图 13

正常肝脏 MRI T2 加权 (**A**) 和弥散加权 (**B**) 序列。

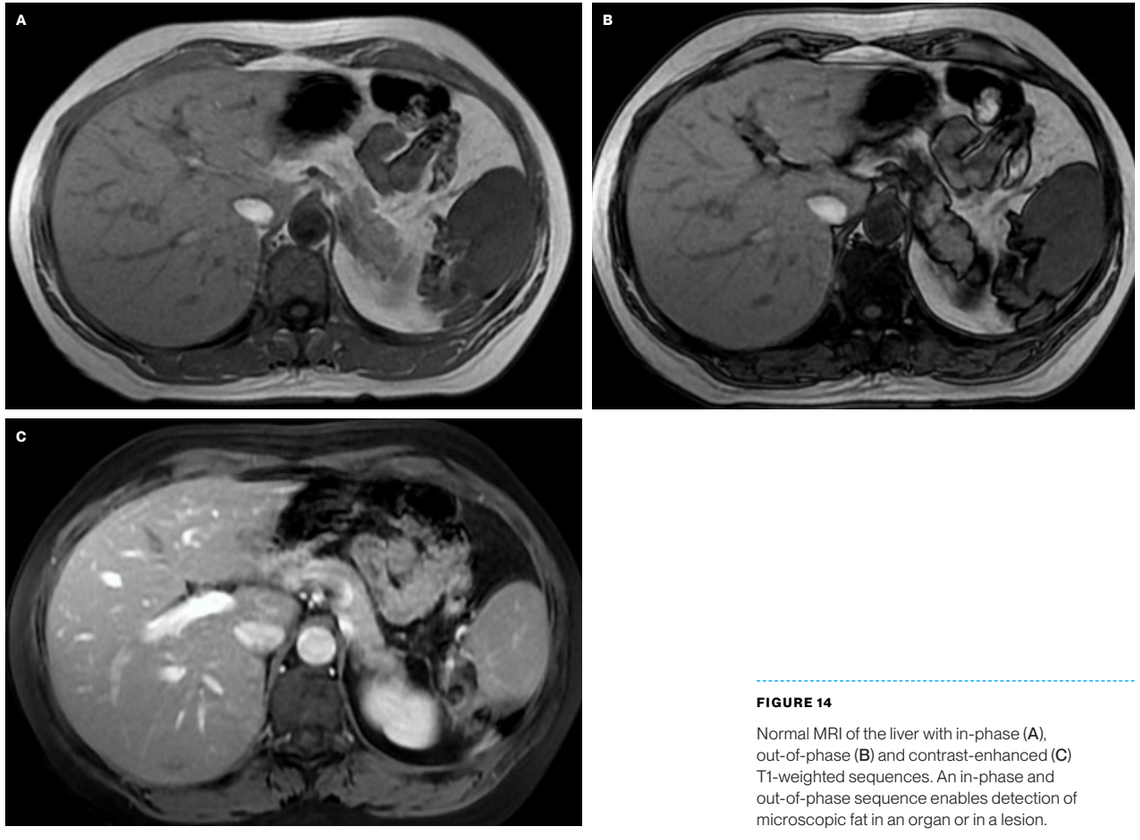


FIGURE 14

Normal MRI of the liver with in-phase (**A**), out-of-phase (**B**) and contrast-enhanced (**C**) T1-weighted sequences. An in-phase and out-of-phase sequence enables detection of microscopic fat in an organ or in a lesion.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

图 14

正常肝脏 MRI，同相位 (**A**)、反相位 (**B**) 和对比增强 (**C**) T1 加权序列。同相位与反相位序列可用于检测器官或病变内的微小脂肪成分。

/ Interventional Procedures

<!> ATTENTION

Catheter angiography is **not** used for diagnostic purposes, however it has an important role in the guidance of therapeutic oncologic interventions, e.g., trans-arterial chemoembolisation (TACE) of malignant lesions.

Patients with severe portal hypertension can be treated by a transjugularly implemented portosystemic shunt (TIPSS).

Image-guided biopsies are useful for the characterisation of lesions with equivocal appearance on US, CT, or MRI.

Percutaneous ablative treatment (radiofrequency, microwave, laser, etc.) of malignant lesions under imaging guidance is a valuable alternative to surgery for the therapy of smaller solitary lesions.

<∞> REFERENCE

Kim Ys et al, RadioGraphics 2011; 31:377–390

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏影像学检查 / 介入治疗

章节大纲：

<! >注意

导管血管成像不用于诊断目的，但其在肿瘤介入治疗中发挥着重要引导作用，例如用于恶性病变的经动脉化疗栓塞（trans-arterial chemoembolisation，TACE）。

重度门静脉高压患者可行经颈静脉门体分流术（transjugularly implemented portosystemic shunt，TIPSS）。

影像引导活检对于 US、CT 或 MRI 表现不明确的病变定性具有重要价值。

在影像引导下对恶性病变进行**经皮消融治疗**（射频、微波、激光等）是较小孤立性病变手术治疗的重要替代方案。

<∞> 参考文献

Kim Ys et al, RadioGraphics 2011; 31:377–390

/ Interventional Procedures

Interventional radiology procedures in the liver are either performed under US, CT or MRI guidance (**Figs. 15-17**).

<!> ATTENTION

Interventional radiologists treat a wide range of liver conditions including the following:

- Liver biopsy to diagnose or confirm a diagnosis
- Abscess drainage to drain pus
- Biliary drain placement and biliary stent placement to drain built-up bile in the presence of bile drain blockage
- Transjugular intrahepatic portosystemic shunt (TIPS) to treat complications of portal hypertension
- Transarterial embolisation of liver tumours (injecting substances into a liver artery to block tumour blood flow as liver tumours are fed by the hepatic artery, whereas normal liver parenchyma is fed by the portal vein)

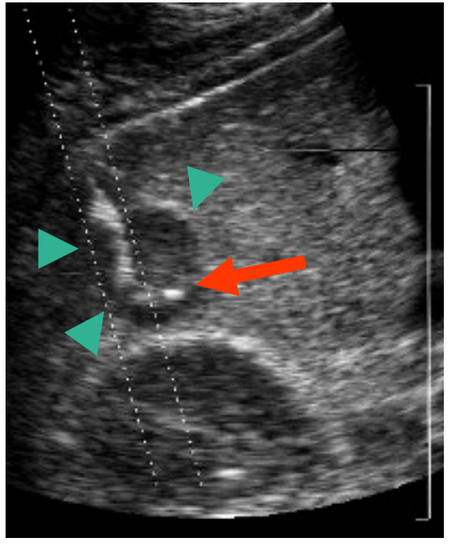


FIGURE 15

US-guided fluid aspiration. The tip of the catheter (**arrow**) is seen in the abscess (**green arrowheads**) of the right liver lobe as a hyperechoic structure.

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏影像学检查

/ 介入治疗

章节大纲：

肝脏介入放射学操作可在 US、CT 或 MRI 引导下进行（**图15-17**）。

<!> 注意

介入放射科医生可治疗多种肝脏疾病，包括：

- 肝活检（用于诊断或确认诊断）
- 脓肿引流（用于排出脓液）
- 胆道引流管置入及胆道支架置入（用于胆道引流管阻塞时引流淤积的胆汁）
- 经颈静脉肝内门体分流术（TIPS，用于治疗门静脉高压并发症）
- 经动脉肝肿瘤栓塞术（向肝动脉内注入栓塞物质以阻断肿瘤血流，因肝肿瘤主要由肝动脉供血，而正常肝实质则由门静脉供血）

图 15

US 引导下液体抽吸。导管尖端（箭头）在肝右叶脓肿（绿色箭头）内呈高回声结构。

FIGURE 16

Contrast-enhanced CT (**A**) depicts an inhomogeneous mass in the liver; non-enhanced preprocedural CT made in the left decubitus position (**B**) shows the lesion as an ill-defined hypodense area; a snapshot CT-scan taken during the biopsy procedure (**C**) shows the tip of the needle in the periphery of lesion.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

图 16

对比增强 CT (**A**) 示肝脏内不均匀肿块；术前左侧卧位非增强 CT (**B**) 显示病变为边界不清的低密度区；活检过程中拍摄的快照 CT 扫描 (**C**) 显示穿刺针尖端位于病变边缘。

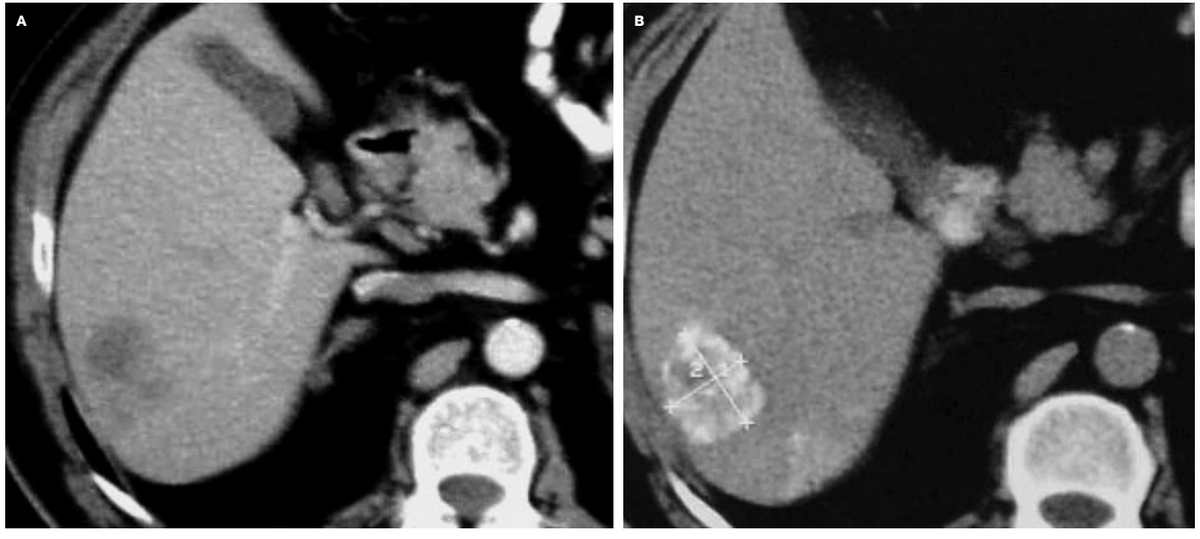


FIGURE 17

CT-scan taken before (**A**) and after (**B**) transarterial chemoembolisation (TACE) of a liver mass: the hyperdense embolising material (Lipiodol UltraFluid) accumulates in the small vessels of the lesion (**B**).

Liver Imaging

CHAPTER OUTLINE:

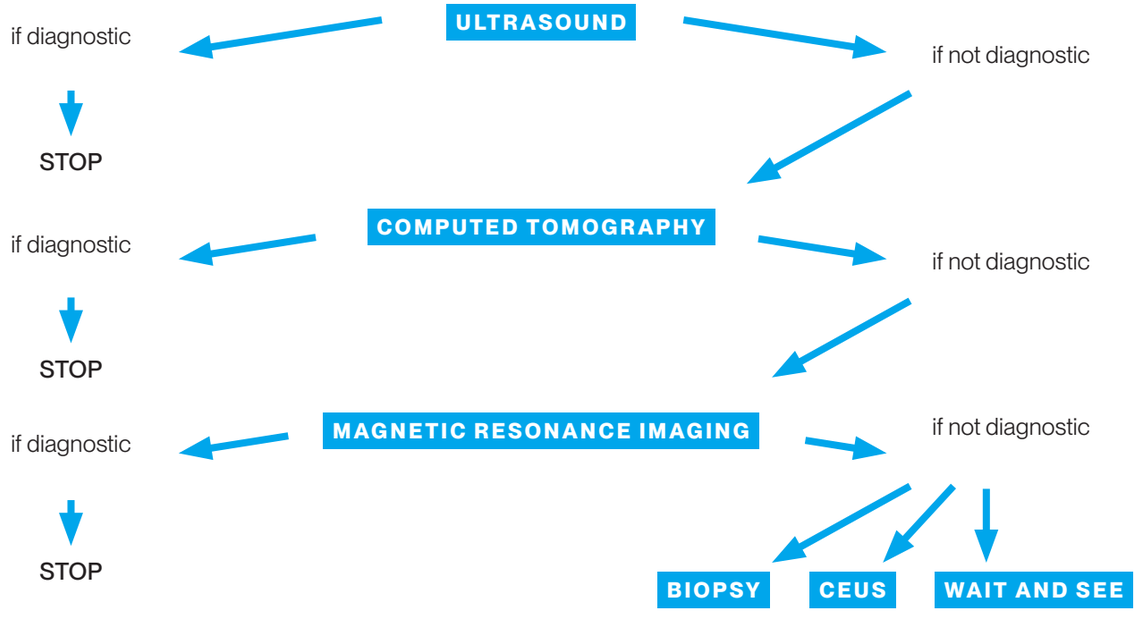
肝脏影像学检查

章节大纲：

图 17

肝脏肿块经动脉化疗栓塞 (TACE) 治疗前 (**A**) 和治疗后 (**B**) 的 CT 扫描：高密度栓塞材料（超液化碘油）聚集于病变小血管内 (**B**)。

Simplified Diagnostic Algorithm (Focal Lesion Detection / Characterisation)



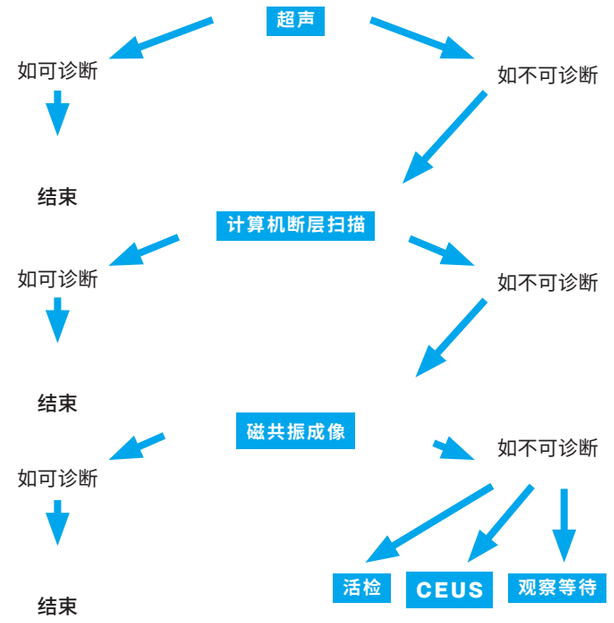
Liver Imaging

CHAPTER OUTLINE:

简化诊断算法 (局灶性病变检测/定性)

肝脏 影像学检查

章节大纲：



Main Indications to Liver Imaging by Pathology

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

按病理分类的肝脏影像学主要适应证

/ Parenchymal Disease

/ Hepatomegaly

It is the consequence of many diffuse parenchymal conditions and extensive focal lesions alike; however, it is difficult to objectively define its degree due to the variability of the shape and size of the normal liver.

<!> ATTENTION

US, CT and MRI are all able to estimate the size of the liver, especially with the assistance of automatic segmentation techniques which are able to calculate not only the dimensions but also the volume of the whole organ or its individual segments.

<∞> REFERENCES

Roloff am et al, Abdom Radiol (2016) 41:1293–1299
Gotra A, Insights Imaging (2017) 8:377–392

FIGURE 18

Coronal CT reformatted image shows a significantly enlarged liver.

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

/ 实质性疾病

章节大纲：

/ 肝肿大

这一表现可见于多种弥漫性实质病变及广泛局灶性病变；然而，由于正常肝脏形态和大小的变异性，其程度难以客观界定。

<!> 注意

US、CT 和 MRI 均能够估计肝脏大小，尤其在自动分割技术的辅助下，不仅能计算肝脏尺寸，还可测量全肝或各肝段的体积。

<∞> 参考文献

Roloff am et al, Abdom Radiol (2016) 41:1293–1299
Gotra A, Insights Imaging (2017) 8:377–392

图 18

冠状位 CT 重建图像显示肝脏明显增大。

/ Steatosis

The most frequently seen diffuse liver condition is **steatosis**, caused by a variety of pathologic conditions (metabolic disease, right heart failure, congenital or acquired venous flow disorders, toxic parenchymal defects, non-alcoholic steatohepatitis, etc.). See **Figs. 19 and 20**.

In **severe steatosis** US may demonstrate diffuse or map-like hyperechogenicity in large areas of the liver, while CT and MRI may depict lower degree of fatty infiltration and provide semiquantitative data defining the level of degeneration.

Steatosis may also be **focal**, or it may happen that there is no fat deposited in circumscribed areas of the diffusely fatty liver (**focal sparing**) – these cases may cause differential diagnostic difficulties to be clarified by CT or MRI.

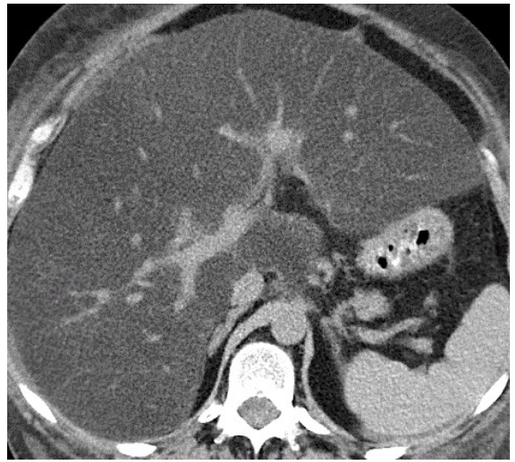


FIGURE 19

Non-enhanced CT shows uniform hypodensity and enlargement of the liver allowing for depiction of vascular structures which are normally visible only on contrast-enhanced scans.

See for comparison Fig. 12a (normal liver parenchyma on **non enhanced** CT image.

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

章节大纲：

/ 脂肪变性

最常见的弥漫性肝脏疾病为**脂肪变性**，其病因多样（代谢性疾病、右心衰竭、先天性或获得性静脉引流障碍、毒性肝实质损伤、非酒精性脂肪性肝炎等）。参见**图19 和 20**。

在**重度脂肪变性**中，US 可表现为肝脏大范围弥漫性或地图样高回声，而 CT 和 MRI 可显示程度较轻的脂肪浸润，并提供半定量数据以评估变性程度。

脂肪变性亦可**呈局灶性分布**，或弥漫性脂肪浸润的肝脏中出现局限性无脂肪沉积区域（**局灶性脂肪保留**）- 此类病例可能需通过 CT 或 MRI 进一步鉴别诊断。

图 19

非增强 CT 可见肝脏均匀低密度伴体积增大，此条件下可清晰显示血管结构（通常仅在对比增强扫描中可见）。

对比参见图 12a（**非增强 CT** 图像上的正常肝实质）。

In phase and out of phase MRI sequences are gradient echo sequences obtained with the **same repetition time value but different echo time values** (see eBook chapter on MRI). The main indication for these types of sequences is to identify **microscopic fat content** in tissues as the signal intensity of tissues containing fat drops on the out of phase images in comparison to the in phase images (**Fig. 20**).

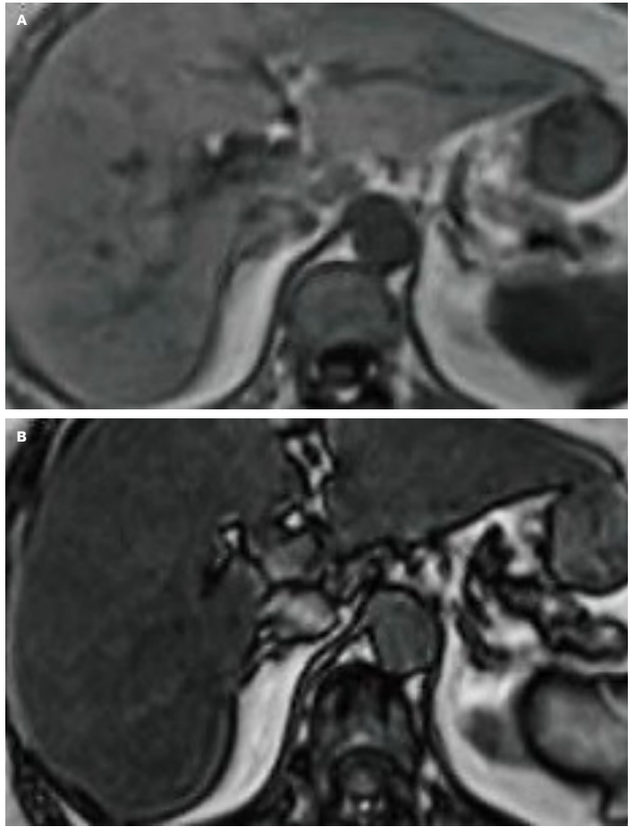


FIGURE 20

In-phase (**A**) and opposed-phase (**B**) T1-weighted MR-scans show significant signal loss in the liver parenchyma on the opposed-phase image due to high concentration of microscopic/intracellular fat deposition.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

同相位与反相位 MRI 序列为梯度回波序列，采用**相同重复时间但不同回波时间**获取（请参阅 MRI 电子书章节）。此类序列的主要适应证是识别组织中的**微小脂肪成分**：含脂肪组织的信号强度在反相位图像中较同相位图像降低（**图 20**）。

图 20

同相位 (**A**) 和反相位 (**B**) T1 加权 MR 扫描显示，因肝实质内大量微小/细胞内脂肪沉积，反相位图像中肝实质信号显著衰减。

/ Cirrhosis

Chronic intoxications (alcohol, drugs) or **chronic progressive conditions** (virus hepatitis C, steato-hepatitis, etc.) can eventually lead to cirrhosis. The condition is characterised by diffuse degeneration, within which focal areas of regenerating liver parenchyma can occur.

Depending on the type of cirrhosis, the US appearance can be fine granular or macronodular, the size of the organ may be **reduced** and its contour may be irregular (**Fig. 21**). The caudate lobe is typically not affected by the overall volume loss; on the contrary, it can appear as relatively enlarged (**Fig. 22**). In advanced cases, signs of portal hypertension (ascites, splenomegaly, oedematous thickening of the bowel- and gall bladder wall) can be seen. Doppler US demonstrates the vascular consequences of cirrhosis (e.g., dilatation of the portal vein and of the periumbilical venous plexus, peri-gastric and splenic collaterals).

<!> ATTENTION

CT and especially MRI play an important role in the **early detection of focal malignant lesions**, frequently occurring in cirrhotic livers (see later).

Oesophageal varicosity is well detectable by endoscopy, but its **extraluminal extent** can be evaluated only by CT. In bleeding varices **interventional radiology** may offer a temporary solution by creating a transjugular intrahepatic portosystemic shunt.

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

/ 肝硬化

章节大纲：

慢性中毒（酒精、药物）或**慢性进展性疾病**（丙型病毒性肝炎、脂肪性肝炎等）最终可进展为肝硬化。该疾病以弥漫性肝细胞变性为特征，可伴局灶性再生肝实质

根据肝硬化类型不同，US 表现可为细颗粒型或大结节型，肝脏体积可缩小且轮廓不规则（图 21）。尾状叶通常不受整体体积缩小的影响；相反，其可能表现为相对增大（图 22）。晚期病例可出现门静脉高压征象（腹水、脾大、肠壁及胆囊壁水肿增厚）。多普勒超声可显示肝硬化的血管并发症（如门静脉及脐周静脉丛扩张、胃周及脾周侧支血管形成）。

<!> 注意

CT 和（尤其是）MRI 在肝硬化常见的局灶性恶性病变的早期检测中具有重要价值（参阅后文）。

食管静脉曲张可通过内镜明确诊断，但其腔外累及范围只能通过 CT 评估。对于出血性静脉曲张，介入放射学可通过建立经颈静脉肝内门体分流术提供临时解决方案。

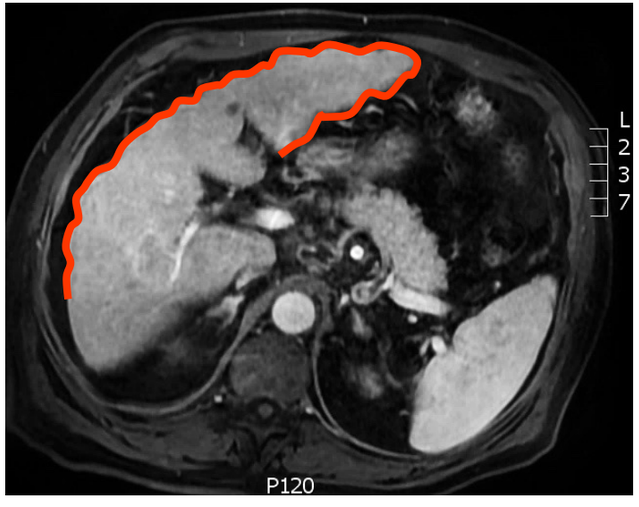


FIGURE 21

Contrast-enhanced T1 fat-suppressed MRI shows a small liver with irregular contours (**red line**).

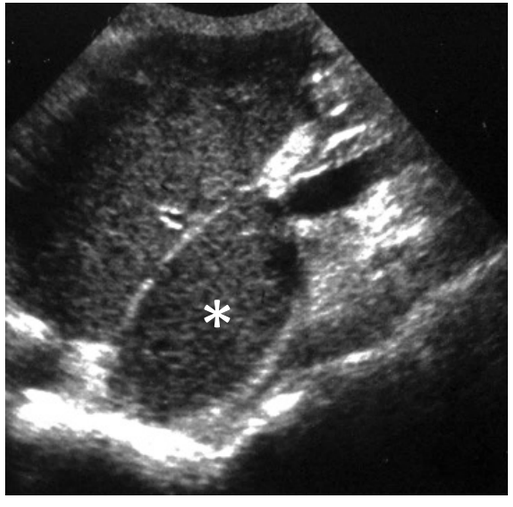


FIGURE 22

Ultrasound image shows coarse liver structure and enlargement of segment 1 (caudate lobe) of the liver (**asterisk**).

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

章节大纲：

图 21

对比增强 T1 脂肪抑制 MRI 显示肝脏体积缩小且轮廓不规则（红线）。

图 22

超声图像显示肝脏结构粗糙，肝段 1（尾状叶）增大（星号）。

/ Focal Liver Disease

Benign

- / Cystic
  - / Simple cyst
  - / Abscess
  - / Parasitic cyst
  - / Biliary hamartoma
- / Vascular
  - / Haemangioma
  - / Peliosis
  - / Veno-occlusive disease
  - / THAD / vascular pseudolesions
  - / Focal steatosis and sparing
- / Hepatocellular
  - / Focal nodular hyperplasia (FNH)
  - / Adenoma

Malignant

- / Hepatocellular Carcinoma (HCC)
- / Hepatoblastoma
- / Fibrolamellar HCC
- / Cholangiocellular Carcinoma (CC)
- / Bile duct cystadenocarcinoma
- / Angiosarcoma
- / Malignant epitheloid haemangioendothelioma
- / Undifferentiated sarcoma
- / Rhabdomyosarcoma
- / Kaposi sarcoma
- / Metastasis
- / Lymphoma

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

/ 局灶性肝脏病变

章节大纲：

良性

- / 囊性
  - / 单纯性囊肿
  - / 脓肿
  - / 寄生虫囊肿
  - / 胆道错构瘤
- / 血管性
  - / 血管瘤
  - / 紫癜病
  - / 静脉闭塞性疾病
  - / THAD/血管假性病变
  - / 局灶性脂肪变性与脂肪浸润缺失
- / 肝细胞性
  - / 局灶性结节性增生 (FNH)
  - / 腺瘤

恶性肿瘤

- / 肝细胞癌 (HCC)
- / 肝母细胞瘤
- / 纤维板层型 HCC
- / 胆管细胞癌 (CC)
- / 胆管囊腺癌
- / 血管肉瘤
- / 恶性上皮样血管内皮瘤
- / 未分化肉瘤
- / 横纹肌肉瘤
- / 卡波西肉瘤
- / 转移瘤
- / 淋巴瘤

/ Cysts

Most cystic liver lesions are **simple cysts**. US reveals rounded lesions of variable size, with thin walls and clear fluid content in an otherwise normal liver (**Fig. 23**). On CT and MRI, cysts have water density/signal and no enhancement (**Figs. 24 and 25**).

Similar lesions but in much bigger number are seen in **hereditary polycystic disease**, which simultaneously affects the liver, pancreas and kidneys. The US diagnosis is usually **straightforward** and no further examinations are required.

Multiple cystic lesions in the liver can be the consequence of **rare biliary developmental disorders**. In these **cases** it is important to differentiate between cystic hamartomas, which do not communicate with bile ducts (**Von Meyenburg disease**), and cystic lesions communicating with the biliary system (**Caroli disease**). The latter can be associated with chronic inflammation and fibrosis, which can lead to liver function insufficiency necessitating transplantation. MR imaging (including MRCP) is the method of choice to assess Caroli cysts communicating with bile ducts (often containing stones), and chronic inflammation and fibrosis surrounding the cysts. The "central dot sign", representing an associated portal vein branch traversing the lumen of the cyst, is pathognomonic (Fig. 26). ERCP can be used to confirm cyst connection to the biliary system.

> See chapter on Biliary Ducts.

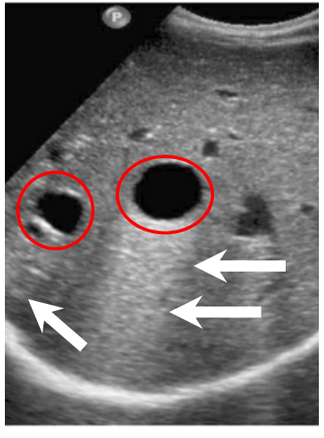


FIGURE 23

Ultrasound image demonstrates two simple cysts with typical posterior "echo enhancement" (**arrows**).

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查 / 囊肿

章节大纲：

大多数肝脏囊性病变为**单纯性囊肿**。US 检查显示为圆形病灶，大小不一，壁薄，内部为澄清液体，肝脏其余部分结构正常（**图 23**）。在 CT 和 MRI 上，囊肿表现为水样密度/信号，无强化（**图24 和 25**）。

在同时累及肝脏、胰腺和肾脏的**遗传性多囊性疾病**中也可观察到类似表现但数量更多的病变。US 对此类病变的诊断通常较为**明确**，无需进一步检查。

肝脏多发性囊性病变可能是**罕见胆道发育异常**的结果。此类**病例**需注意鉴别不与胆管相通的囊性错构瘤（**Von Meyenburg 病**）与和胆道系统相通的囊性病变（**Caroli 病**）。后者常合并慢性炎症及纤维化，可能导致肝功能不全，甚至需肝移植。MR 成像（包括 MRCP）是评估与胆管相通的 Caroli 囊肿（常含结石）及囊肿周围慢性炎症、纤维化的首选方法。“中心点征”（表现为穿行于囊腔的伴行门静脉分支）具有特征性（图 26）。ERCP 可用于确认囊肿与胆道系统的连通性。**> 请参阅《胆管》中的章节。**

图 23

超声图像显示两个典型单纯性囊肿，可见后方“回声增强”（箭头）。

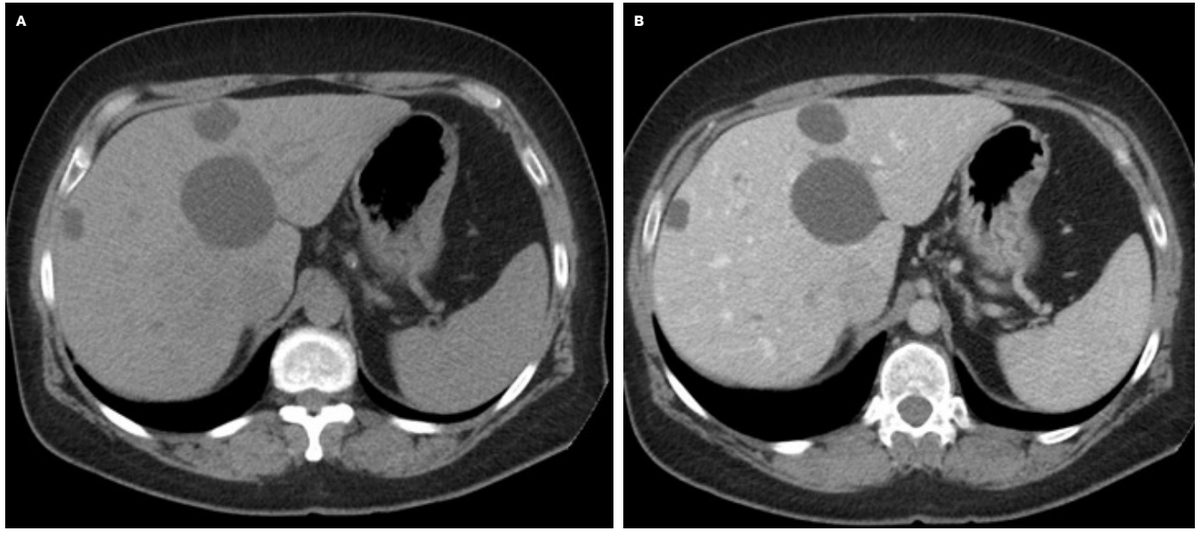


FIGURE 24

Non-enhanced (**A**) and contrast-enhanced (**B**) CT scans demonstrate multiple benign cysts (water density, well-defined, no enhancement).

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

章节大纲：

图 24

非增强 (**A**) 和对比增强 (**B**) CT 扫描显示多发性良性囊肿（水样密度、边界清晰、无强化）。

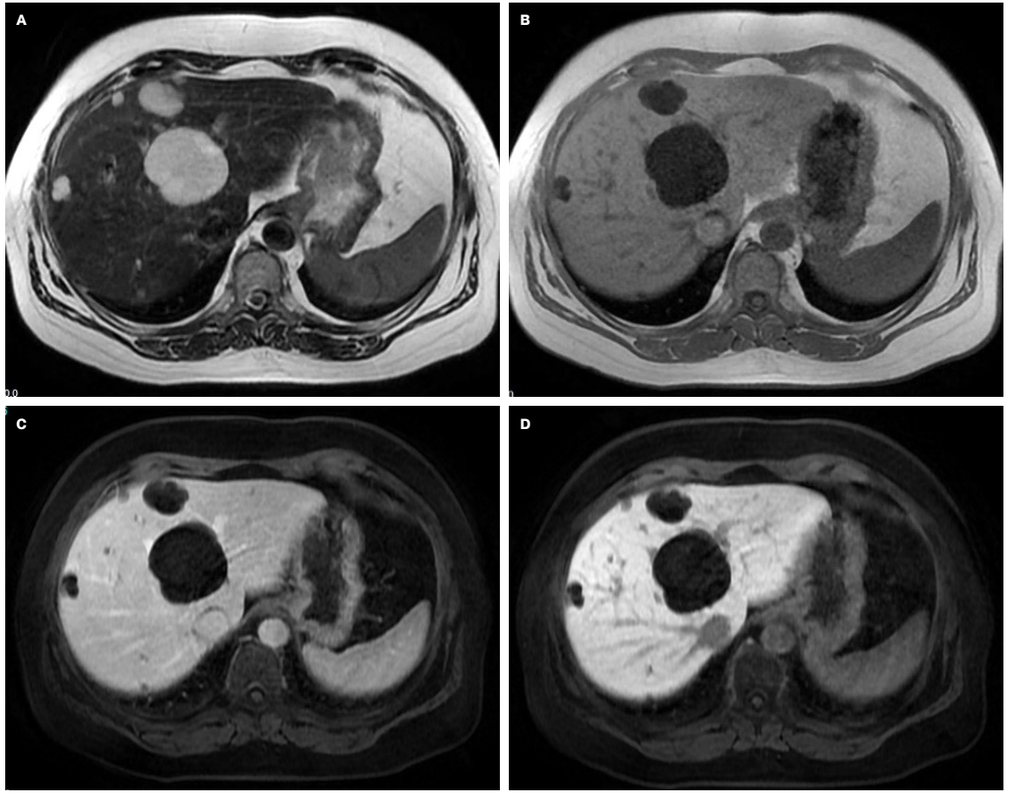


FIGURE 25

Same patient as in Fig. 24. T2-weighted (**A**), T1-weighted (**B**), postcontrast parenchymal phase (**C**) and hepatobiliary phase (**D**) 3D GRE fat-supressed MRI shows multiple benign cysts (water signal intensity, no enhancement))

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查

章节大纲：

图 25

与图 24 为同一患者。T2 加权 (**A**)、T1 加权 (**B**)、增强后实质期 (**C**) 和肝胆期 (**D**) 3D GRE 脂肪抑制 MRI 显示多发性良性囊肿（水样信号强度，无强化）

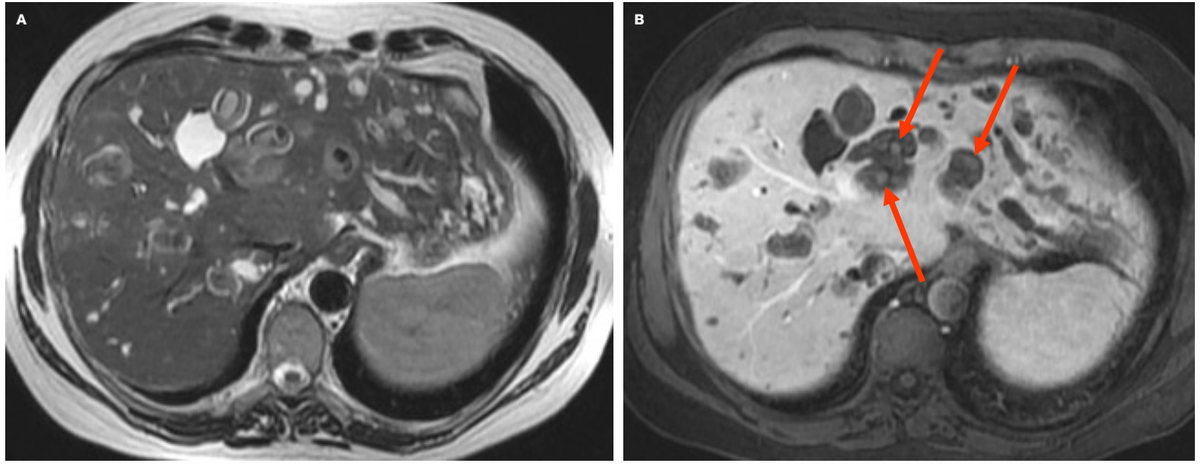


FIGURE 26

T2-weighted (**A**) and T1-weighted (**B**) MRI sequences demonstrate multiple complex cysts with features characteristic of Caroli disease. Arrows point at the central dot sign.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

图 26

T2 加权 (**A**) 和 T1 加权 (**B**) MRI 序列显示多发性复杂囊肿，符合 Caroli 病特征。箭头示“中心点征”。

- **Echinococcus (hydatid) cysts** have two subtypes. One subtype is characterised by a big cyst with a thick and sometimes calcified wall, including a partially detached endoluminal germinative layer, often associated with smaller, "daughter"-cysts. The multilocular subtype consists of multiple small cysts, separated by thick, frequently calcified walls and septa, giving the impression of a neoplastic lesion. Laboratory data and US, CT and MRI results are often diagnostic but rarely a percutaneous biopsy is necessary for the final diagnosis. However, puncturing a hydatid cyst can result in a severe hypersensitivity reaction due to cyst content leaking along the needle track into the abdomen.
- **Liver abscesses** are typically thick-walled, round-shaped or irregular focal lesions with thick walls, a dense fluid content and an ill-defined external contour. US is mostly diagnostic; in case of doubt, CT reveals mild to moderate wall enhancement and MR shows diffusion restriction of the purulent content. US can be used to guide percutaneous aspiration and drainage.

<!> ATTENTION

- **Certain neoplastic conditions** (necrotic tumours, metastases from GIST, cystadenocarcinoma, certain squamous cell carcinomas) can present as cystic focal lesions. Ill-defined contour, thick fluid content, wall enhancement, detectable by CT or MR evoke a possible malignant background.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

- **肝包虫**（棘球蚴）**囊肿**分为两型。一型表现为大囊肿，囊壁厚且可钙化，囊内可见部分脱离的内层生发层，常伴多发子囊。另一型为多房性，由多个小囊肿组成，囊壁及分隔厚且常钙化，易被误认为肿瘤性病变。实验室数据以及 US、CT 和 MRI 结果通常可明确诊断，仅少数需经皮穿刺活检进行最终诊断。但需注意，穿刺肝包虫囊肿可能因囊液沿针道漏入腹腔引发严重超敏反应。
- **肝脓肿**典型表现为厚壁、圆形或不规则局灶性病变，囊内为浓稠液体成分，边界不清。US 多可确诊；存疑时，CT 可见囊壁轻至中度强化，MR 显示脓性内容物弥散受限。US 可用于引导经皮穿刺抽吸和引流。

<!> 注意

- **部分肿瘤性疾病**（坏死性肿瘤、GIST 转移瘤、囊腺癌、某些鳞状细胞癌）可表现为囊性局灶性病变。CT 或 MR 可检测到边界不清、囊内液体浓稠、囊壁强化，提示可能存在恶性可能。

Solid Benign

- In some cases **US characteristics** of a solid lesion can predict its nature but most of the time contrast-enhanced US, CT or MRI are needed for proper characterisation.

<!> ATTENTION

- Smaller, isoechoic foci **may be missed by US**, therefore, if the clinical situation requires clarification (e.g., prior to planning an oncologic treatment), **MRI must be performed** even after a negative US examination!

- The most common benign solid liver lesions are:
  - haemangioma
  - focal steatosis / focal sparing
  - focal nodular hyperplasia
  - adenomas

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

实性良性病变

章节大纲：

- 部分情况下，US 对实性病变的**特征描述**可进行定性诊断，但多数时候需结合超声造影、CT 或 MRI 进行准确定性。
- 最常见的实性良性肝脏病变包括：
  - 血管瘤
  - 局灶性脂肪变性/局灶性脂肪缺失
  - 局灶性结节性增生
  - 腺瘤

<!> 注意

- 较小的等回声灶**可能会被** US **漏诊**，因此，若临床需要明确诊断（如制定肿瘤治疗方案前），即使超声检查结果为阴性，**仍需行 MRI 检查！**

Solid Benign – Haemangioma

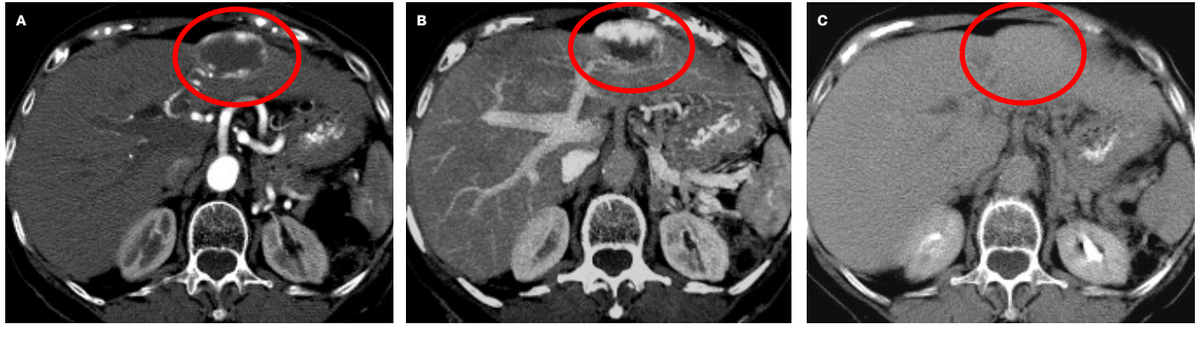
The most frequent solid focal lesion of the liver is **haemangioma** (**Figs. 27 and 28**). At US, it typically appears as a well-defined, rounded hyperechoic area. **Cavernous haemangioma** demonstrates a characteristic enhancement pattern at US, CT and MRI: the initial peripheral, irregular contrast accumulation slowly moves centripetally, and eventually involves the whole lesion (**Figs. 27 and 28**); the MRI signal intensity is also typical: high T2 and low T1 with moderate diffusion restriction.

Capillary haemangioma is typically small and shows fast and intensive central enhancement.

>▪< FURTHER KNOWLEDGE

FIGURE 27

Arterial phase (**A**), portal phase (**B**) and delayed phase (**C**) postcontrast CT shows a typical haemangioma, initially enhancing at its periphery and gradually filling in later.



Liver Imaging

CHAPTER OUTLINE:

实性良性病变 - 血管瘤

肝脏最常见的实质性局灶性病变是**血管瘤**（**图27 和 28**）。在 US 下，通常表现为边界清晰的圆形高回声区。**海绵状血管瘤**在 US、CT 和 MRI 中均呈现特征性强化模式：初始外周不规则对比剂聚集缓慢向心性填充，最终累及整个病灶（**图27 和 28**）；MRI 信号强度亦典型：T2 高信号、T1 低信号伴中度弥散受限。**毛细血管瘤**通常较小，表现为快速且显著的中心强化。

肝脏影像学检查

章节大纲：

>▪< 进阶知识

图 27

动脉期 (A)、门静脉期 (B) 和延迟期 (C) 增强后 CT 示典型血管瘤，初始周边强化，随后逐渐填充。

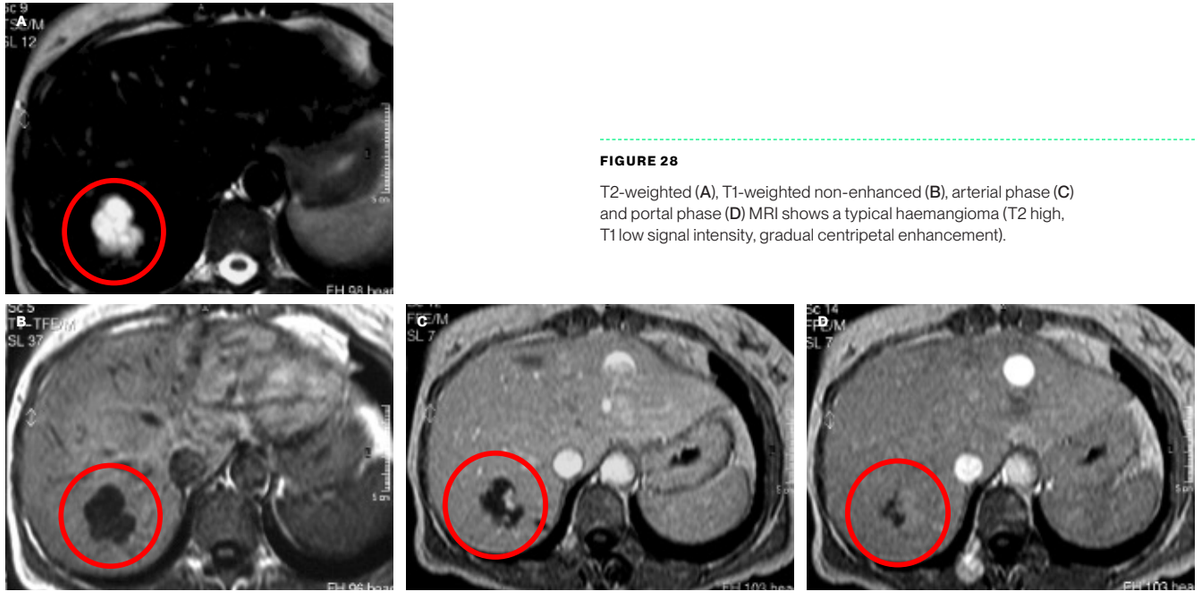


FIGURE 28

T2-weighted (**A**), T1-weighted non-enhanced (**B**), arterial phase (**C**) and portal phase (**D**) MRI shows a typical haemangioma (T2 high, T1 low signal intensity, gradual centripetal enhancement).

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

图 28

T2 加权 (**A**)、T1 加权非增强 (**B**)、动脉期 (**C**) 和门静脉期 (**D**) MRI 示典型血管瘤（T2 高信号强度、T1 低信号强度，向心性渐进强化）。

Solid Benign – Focal Sparing

- **Focal steatosis** appears as a hyperechoic, but less regular, sometimes geographical area on US, while on CT low density and on MRI signal loss on out-of-phase images are characteristic. In case of any doubt, MRI allows the definitive diagnosis as focal steatosis lesions never show restricted diffusion and they normally enhance after hepatobiliary contrast agent administration.
- **Focal sparing** (normal parenchymal areas in fatty liver) appears less echogenic than the fatty environment at US, CT and MRI. CT and MRI depict liver steatosis and also areas lacking fat (= focal sparing, **Figs. 29 and 30**), while diffusion-weighted MRI and contrast-enhanced measurements – similarly to focal steatosis – do not detect any alteration in the target area.

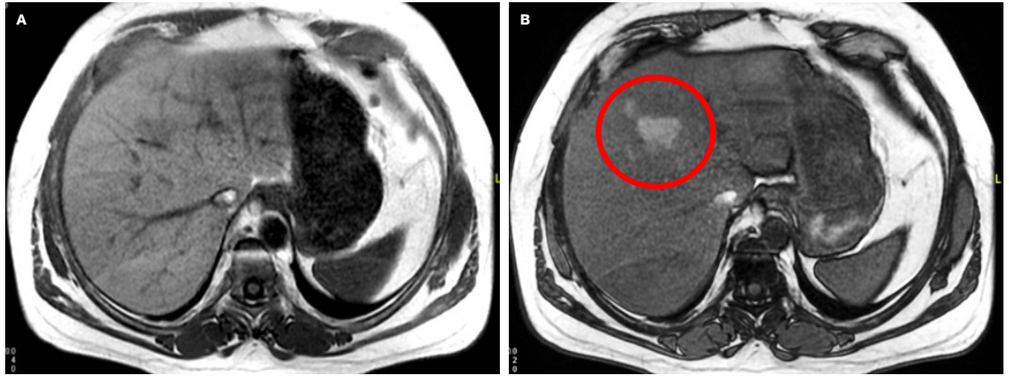


FIGURE 29

In-phase (**A**) and out-of-phase (**B**) MR images show signal loss in the steatotic liver parenchyma, with the exception of a small area of focal sparing.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

实性良性病变 – 局灶性脂肪缺失

章节大纲：

- **局灶性脂肪变性**在 US 上表现为高回声区，但形态不规则，有时呈地图样；CT 表现为低密度；MRI 表现为反相位图像信号丢失。存疑时，MRI 可明确诊断，因局灶性脂肪变性病灶无弥散受限，并且通常在给予肝胆对比剂后增强。
- 在 US、CT 和 MRI 中，**局灶性脂肪缺失**（脂肪肝中的正常肝实质区域）的回声低于周围脂肪组织的回声。CT 和 MRI 可显示肝脂肪变性及脂肪缺失区域（= 局灶性脂肪缺失，**图29 和 30**），而弥散加权 MRI 和对比增强测量（类似于局灶性脂肪变性）未检测到目标区域任何改变。

图 29

同相位 (**A**) 和反相位 (**B**) MR 图像显示脂肪变性肝实质信号丢失，仅小片局灶性脂肪缺失区域信号保留。

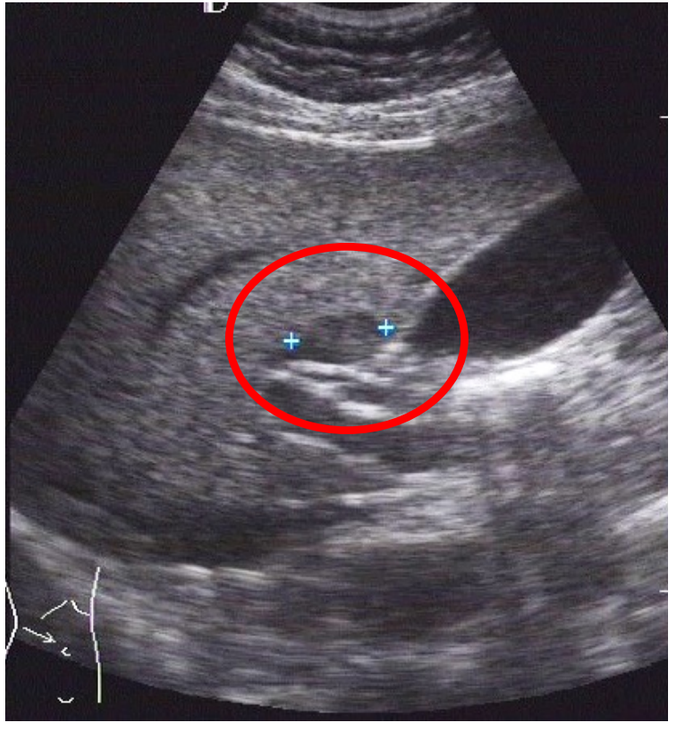


FIGURE 30

US image shows small hypoechoic area within the homogeneously hyperreflective liver, consistent with focal sparing within diffuse steatosis.

Liver Imaging

CHAPTER OUTLINE:

肝脏 影像学检查

章节大纲：

图 30

US 图像显示均匀高回声肝脏内小片低回声区，符合弥漫性脂肪变性基础上的局灶性脂肪缺失。

Solid Benign – Hepatobiliary - FNH

- **Focal nodular hyperplasia (FNH, Figs. 31 -33)**, if detected by US, is well-defined, often subcapsular or exophytic and of variable echogenicity; however, it can be almost invisible at non-enhanced US, CT and MRI. After contrast administration, it has a characteristic enhancement: almost homogeneous, very fast and intensive in the arterial phase, a similar enhancement as normal liver parenchyma in the portal phase, thus making the lesion hardly visible (**vanishing lesion**). In most cases a slow and prolonged enhancement in the centre of the lesion (**central scar**) is seen, which represents a connective tissue rich vascular bundle. FNH enhances after hepatobiliary contrast agents similarly to normal liver parenchyma.

- **Adenomas** may have a similar appearance to FNH (isoechoic on US, intensive arterial contrast enhancement, levelling off in the portal phase at CT and MR), but unlike FNH, adenomas have the tendency to grow, accumulate fat, develop a capsule, and contain haemorrhage, and/or undergo rupture, depending on the lesion subtype. Another important difference is that biliary excretion is reduced or missing, thus enhancement after hepatobiliary contrast agents is significantly lower than in FNH.

FIGURE 31

US shows a large, well-defined, moderately hyperechoic mass behind the liver hilum.

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

章节大纲：

实性良性病变 - 肝胆 - FNH

- **局灶性结节性增生（FNH，图31 - 33）**若被 US 检出，通常边界清晰，多位于肝包膜下或向外突出，回声可不均；但在超声造影、CT 和 MRI 中几乎不可见。给予对比剂后，呈现特征性强化：动脉期几乎均匀、快速且显著强化，门静脉期强化程度与正常肝实质相似，使病灶显示不清（**消失的病灶**）。多数病例可见病灶中心缓慢持续的强化（**中央瘢痕**），代表富含结缔组织的血管束。使用肝胆对比剂后，FNH 增强与正常肝实质相似。

- **腺瘤**表现与 FNH 可能相似（在 US 上呈等回声，在 CT 和 MR 上动脉期显著对比增强，门静脉期趋于平稳），但与 FNH 不同的是，腺瘤有增大、脂肪沉积、形成包膜、合并出血和/或破裂的倾向，具体取决于病变亚型。另一重要区别是腺瘤胆汁排泄减少或缺失，因此使用肝胆对比剂后强化程度显著低于FNH。

图 31

US 显示肝门后方可见一边界清晰、中等高回声的肿块。

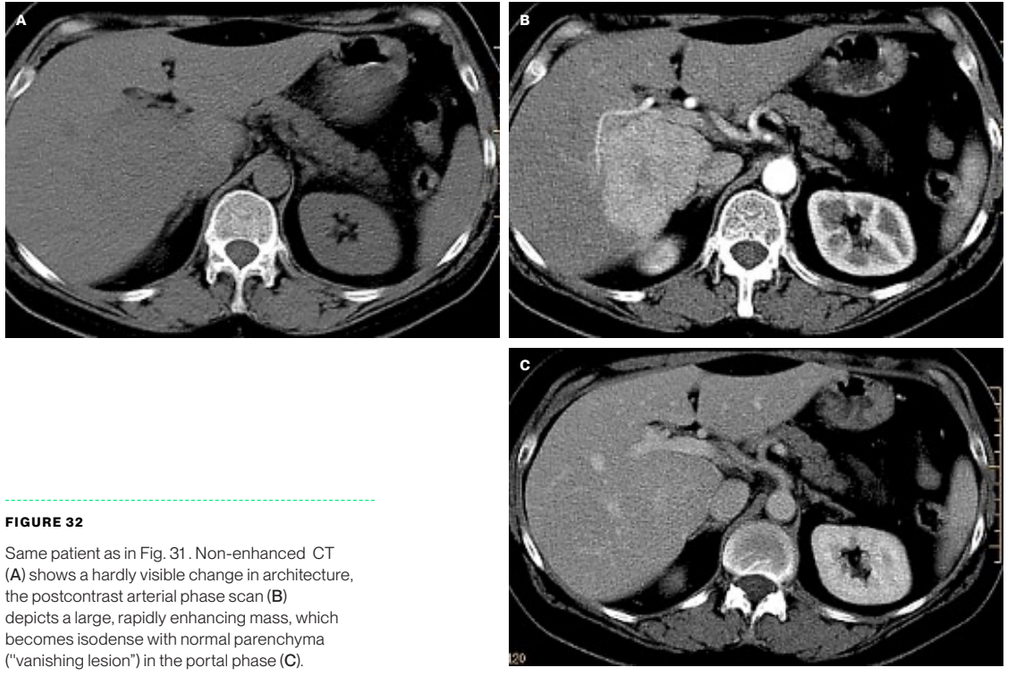


FIGURE 32

Same patient as in Fig. 31 . Non-enhanced CT (**A**) shows a hardly visible change in architecture, the postcontrast arterial phase scan (**B**) depicts a large, rapidly enhancing mass, which becomes isodense with normal parenchyma ("vanishing lesion") in the portal phase (**C**).

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章节大纲：

图 32

与图 31 为同一患者。平扫 (**A**) 显示结构改变几乎不可见，增强后动脉期扫描 (**B**) 示一快速强化的大肿块，该肿块在门静脉期 (**C**) 与正常肝实质等密度（“消失的病灶”）。

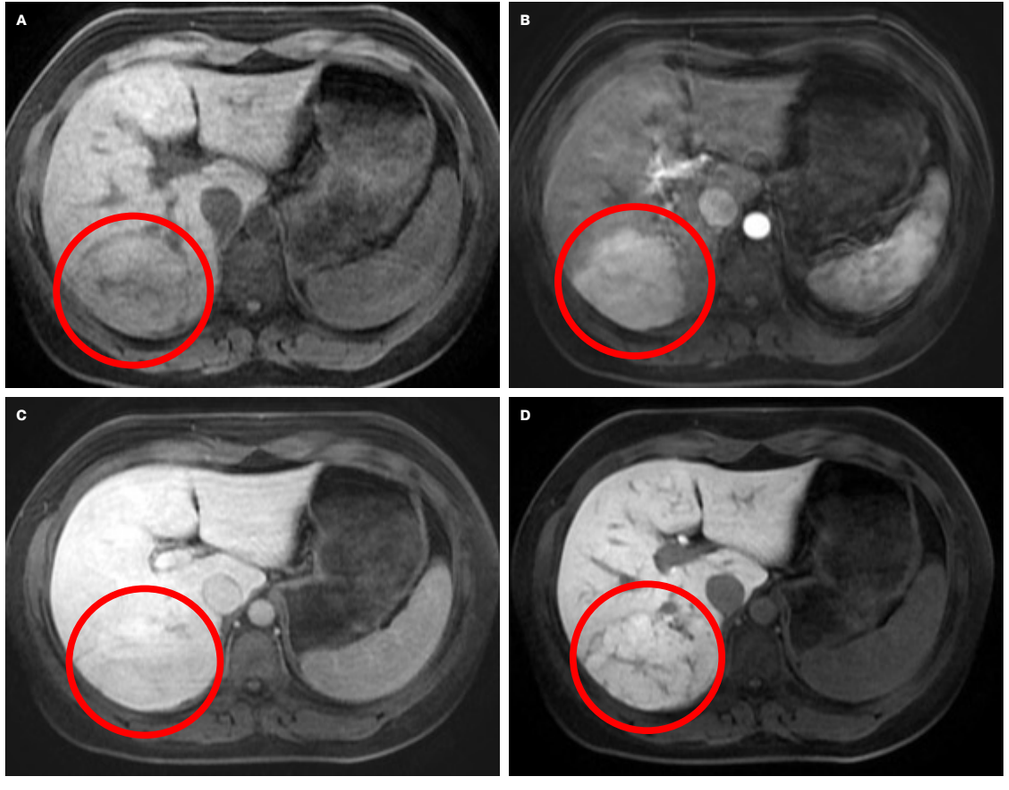

FIGURE 33

Non-enhanced (**A**), postcontrast arterial phase (**B**), parenchymal phase (**C**) and hepatobiliary phase (**D**) MRI shows a large mass in the right lobe of the liver, showing intensive arterial enhancement, becoming isointense with normal liver parenchyma in the portal and hepatobiliary phase.

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/ 肝脏 影像学检查

章节大纲：

图 33

平扫 (**A**)、增强后动脉期 (**B**)、实质期 (**C**) 和肝胆期 (**D**) MRI 显示肝右叶大肿块，动脉期显著强化，门静脉期及肝胆期与正常肝实质信号一致。

Primary Malignant

- **Hepatocellular carcinoma** (HCC) is the **most frequent primary liver malignancy**, mostly developing from hyperplastic-dysplastic nodules in a **cirrhotic liver**. Hyperplastic nodules have a portal blood supply (as normal liver parenchyma). Depending on the level of dysplasia, arterial blood supply increasingly takes over and becomes exclusive in overt HCC. HCC can also develop in the non-cirrhotic liver, and this type of HCC also has intensive arterial-phase contrast enhancement.

<!> ATTENTION **>▪< FURTHER KNOWLEDGE**

- The **difference** between the enhancement pattern of **HCC** and **adenoma/FNH** is that in HCC a very fast contrast agent washout in the portal or early delayed phase is seen, as opposed to the much slower washout in benign lesions (**Figs. 34, 35**). HCC also demonstrates restricted diffusion and lack of enhancement in the hepatobiliary phase. Vascular invasion and satellite lesions are best detected on MRI. In bigger, more advanced lesions enhancement may be less intensive, and the structure more inhomogeneous, due to necrosis, bleeding and calcification, all easily depicted by CT and MRI.
- The **fibrolamellar HCC subtype** is usually a bigger, infiltrative lesion with a characteristic calcification in the central parts.
- Interventional radiology plays an important role in the **treatment of HCC** by performing percutaneous thermal (radiofrequency, cryo- or laser-) ablation, transarterial chemo- or radioembolisation.

- **Intrahepatic cholangiocellular carcinomas** (ICCC) also occur more frequently in the **cirrhotic liver** but can also develop in the normal liver.

<!> ATTENTION

>▪< FURTHER KNOWLEDGE

- The intraductal papillary and periductal infiltrative forms are difficult to visualise at imaging. At US only localised, segmental dilatation of the affected bile ducts is often seen. The lesion itself is best detected by diffusion-weighted MRI. Detection of the mass-forming ICCC type is easier, but many times it is difficult to identify its biliary origin. ICCC shows slow, progressive, late enhancement due to extensive, dense connective tissue components. The contour of the liver may show indentation in the proximity of the lesion, but the sign is not specific.
  > See also chapter on Biliary Ducts.

<∞> REFERENCE

Fraum TJ et al, Radiology 2018; 286:158–172

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查

原发性恶性肿瘤

章节大纲：

- 肝细胞癌 (HCC) 是最常见的原发性肝恶性肿瘤，多由**肝硬化**背景下的增生-异型增生结节发展而来。增生结节有门静脉血供（与正常肝实质一致）。随着异型增生程度的加重，动脉血供逐渐增加，并在典型 HCC 中成为唯一血供来源。HCC 也可发生于非肝硬化背景，此类 HCC 同样表现为显著的动脉期对比增强。

<!> 注意 **>▪< 进阶知识**

- **HCC 与腺瘤/FNH** 的强化模式差异在于：HCC 在门静脉期或早期延迟期可见显著的对比剂快速廓清，而良性病变的廓清速度则显著缓慢（**图34、35**）。HCC 也表现出弥散受限，肝胆期无强化。血管侵犯及卫星病灶在 MRI 上显示最佳。对于更大、更晚期病灶，由于坏死、出血及钙化，其强化程度可能减弱，结构更不均匀，在 CT 和 MRI 上易显示。
- **纤维板层型 HCC** 亚型通常为较大的浸润性病灶，中央区可见特征性钙化。
- 介入放射学通过经皮热消融（射频、冷冻或激光消融）、经动脉化疗栓塞或放射性栓塞在 **HCC 治疗**中发挥重要作用。

- **肝内胆管细胞癌** (ICCC) 同样多见于**肝硬化背景**，亦可发生于正常肝脏。

<!> 注意

>▪< 进阶知识

- 影像学检查难以观察到导管内乳头状和导管周围浸润性病变。US 检查中，仅常显示受累胆管的局限性节段性扩张。病灶本身在弥散加权 MRI 上显示最佳。肿块型 ICCC 较易检出，但其胆管源性常难以明确。由于富含大量致密结缔组织成分，ICCC 表现为缓慢、渐进性延迟强化。病变邻近区域肝脏轮廓可出现凹陷，但此征象缺乏特异性。
  > 另请参阅《胆管》中的章节。

<∞> 参考文献

Fraum TJ et al, Radiology 2018; 286:158-172

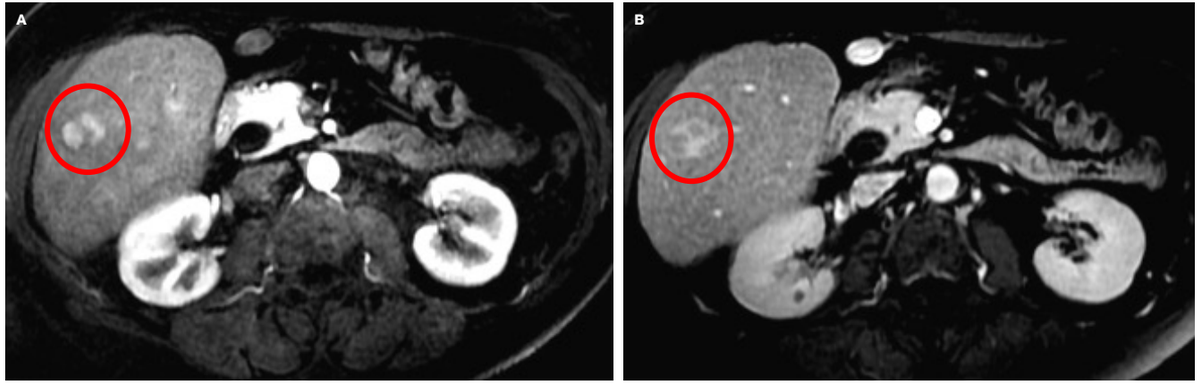

FIGURE 34

Arterial phase (**A**) and parenchymal phase T1-weighted MRI shows a lesion which enhances centrally in the arterial phase and in the periphery in the portal phase ("nodule in nodule": early HCC).

Liver Imaging

CHAPTER OUTLINE:

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章节大纲：

图 34

动脉期 (**A**) 和实质期 T1 加权 MRI 显示动脉期病灶中央强化，门静脉期周边强化（“结中结节”：早期 HCC）。

/ Primary Malignant - HCC

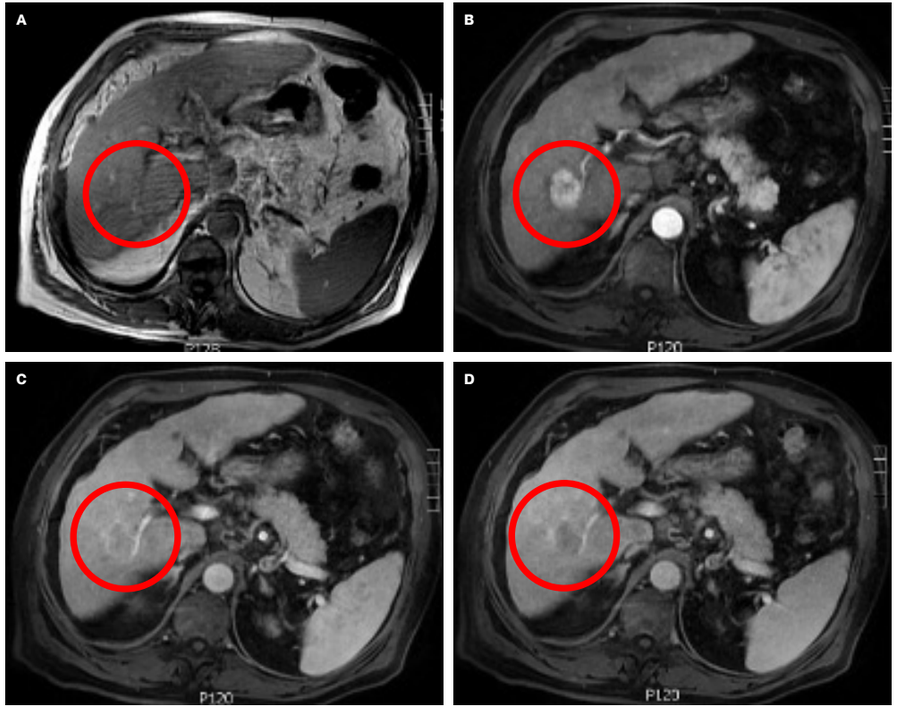

FIGURE 35

Non-enhanced (**A**), postcontrast arterial phase (**B**), portal phase (**C**) and delayed phase T1-weighted MRI sequences shows a lesion with rapid arterial enhancement (wash-in) and fast wash-out in the later phases, with rim enhancement (the pattern is typical for HCC).

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/ 肝脏 影像学检查 / 原发性恶性肿瘤 - HCC

章节大纲：

图 35

平扫 (**A**)、增强后动脉期 (**B**)、门静脉期 (**C**) 和延迟期 T1 加权 MRI 序列显示病灶动脉期快速强化（快进），后期快速廓清，并可见环周强化（此为 HCC 的典型模式）。

Secondary Malignant

- The most frequent hepatic malignant lesions are the **haematogenous metastases** (20-40 times more common than HCC). At US they are typically hypoechoic (in 65% of cases), round-shaped, well defined lesions of various diameters (**Fig. 36**). As they have an arterial blood supply but typically a low level of vascularity, they show minimal to moderate, inhomogeneous (often peripheral) enhancement in the arterial phase, and despite central filling in the portal phase, there is **slow wash-out** in **the delayed phase**, which helps to distinguish them from haemangioma (**Fig. 37**).
- Liver manifestations of **malignant lymphomas** are rare. Lymphomas are typically large, sometimes confluent, hypoechoic, hypodense lesions with minimal enhancement.

>▪< FURTHER KNOWLEDGE

<!> ATTENTION

- The presence or absence of metastases is **best assessed by MRI (Fig. 38)**, on which metastatic lesions appear as areas of diffusion restriction (lower ADC than surrounding liver parenchyma), with no enhancement in the hepato-biliary phase.
- The primary tumour type influences the **appearance of metastases** (hypervascular tumours tend to have hypervascular metastases, melanoma metastases have a special MRI signal profile due to their melanin content, cystic tumours tend to have cystic metastases, etc.).
- **US-guided biopsy** is necessary to clarify the origin of an unknown primary cancer or to understand changes in the genetic profile of the tumour during the process of haematogenous dissemination.
- Metastases can also be **treated by image-guided ablative interventions** if their number and size does not exceed a certain limit).

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肝脏影像学检查

章节大纲：

继发性恶性肿瘤

- 最常见的肝恶性病变是**血行转移瘤**（发生率比 HCC 高 20-40 倍）。US 检查中通常表现为低回声（占 65% 的病例）、类圆形、边界清晰的病灶，直径不一（**图 36**）。由于它们具有动脉血供但通常血供程度较低，因此在动脉期表现为轻度至中度、不均匀（常为周边）强化；尽管门静脉期可见中央填充，但**延迟期**表现为**缓慢廓清**，这一特征有助于与血管瘤相鉴别（**图 37**）。
- **恶性淋巴瘤**的肝脏受累较为罕见。淋巴瘤典型表现为较大、有时呈融合性的低回声/低密度病变，强化程度轻微。

>▪< 进阶知识

<!> 注意

- **MRI 是评估是否存在转移瘤的最佳检查手段**（**图 38**），转移瘤在 MRI 上表现为弥散受限区域（ADC 低于周围肝实质），且在肝胆期无强化。
- 原发肿瘤类型会影响**转移瘤的表现**（富血供肿瘤往往形成富血供转移灶；黑色素瘤转移灶因含黑色素成分，在 MRI 上具有特殊信号特征；囊性肿瘤则倾向于形成囊性转移灶等）。
- 对于原发灶不明的癌症，或需了解肿瘤在血行播散过程中基因特征的变化时，需通过 **US 引导下活检**明确诊断。
- 若转移瘤数量及大小未超过一定限度，还可采用**影像引导下消融治疗**。

/ Secondary Malignant – Metastasis

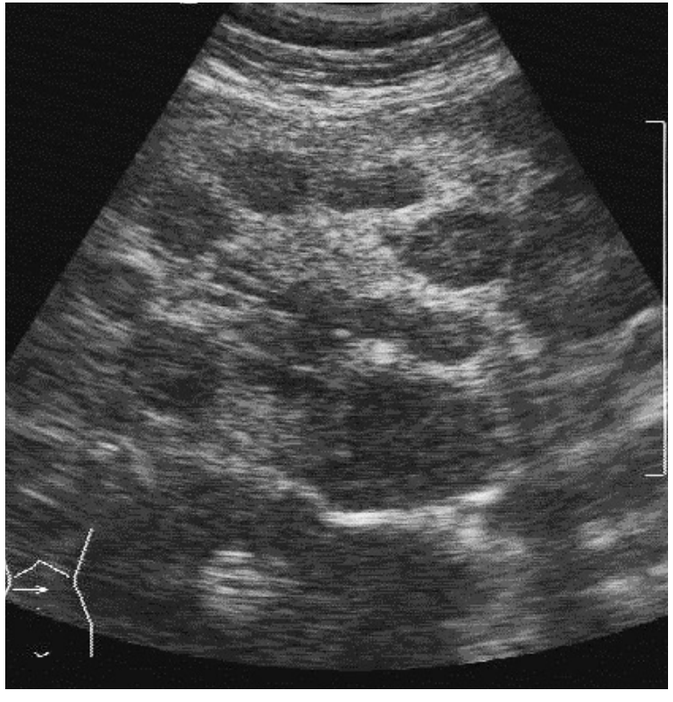

FIGURE 36

Ultrasound examination reveals multiple well-defined round-shaped/oval hypoechoic metastatic lesions in the liver.

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/ 肝脏 影像学检查 / 继发性恶性肿瘤 - 转移瘤

章节大纲：

图 36

超声检查示肝内多处边界清晰的圆形/椭圆形低回声转移灶。

FIGURE 37

Arterial (**A**) and portal (**B**) phase CT scans depict multiple well-defined, round-shaped, hypodense metastatic lesions, showing only minimal peripheral enhancement in the arterial phase.

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章节大纲：

图 37

动脉期 (**A**) 和门静脉期 (**B**) CT 扫描显示多个边界清晰、圆形、低密度转移灶，仅动脉期可见轻度周边强化。

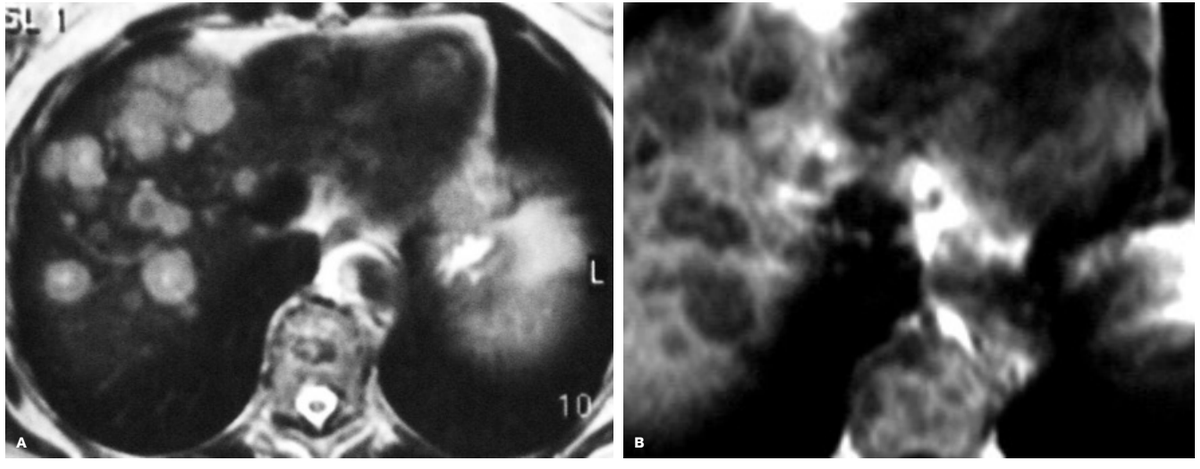

FIGURE 38

T2-weighted (**A**) and T1-weighted (**B**) MRI scans show multiple round-shaped metastases in the liver.

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CHAPTER OUTLINE:

/ 肝脏 影像学检查

章节大纲：

图 38

T2 加权 (**A**) 和 T1 加权 (**B**) MRI 扫描显示肝内多发圆形转移灶。

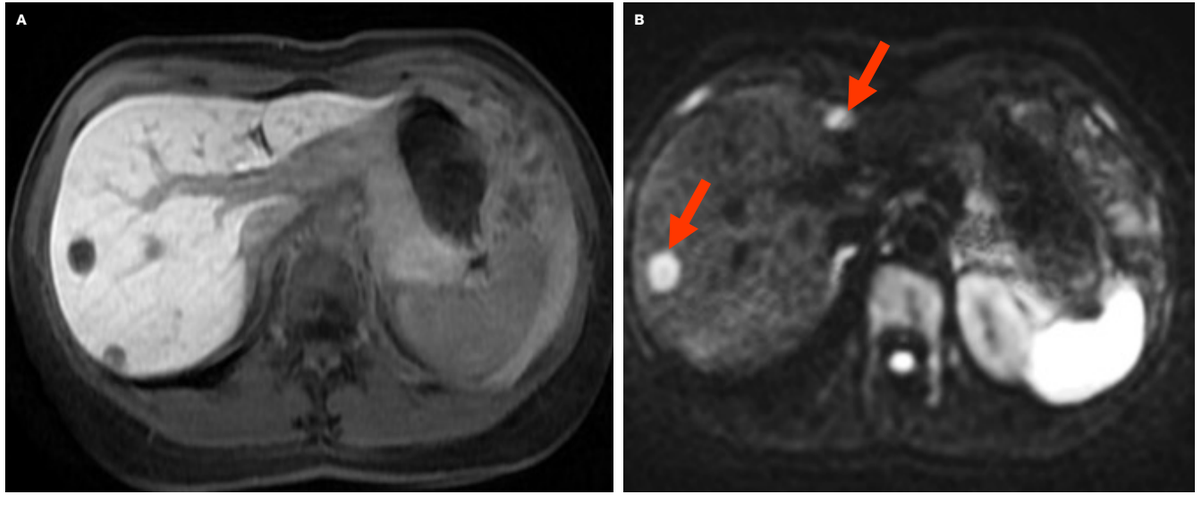

FIGURE 39

Hepatobiliary phase contrast-enhanced T1- (**A**) and diffusion-weighted (**B**) MR images show small non-enhancing metastatic lesions with diffusion restriction (bright signal in **B**, **arrows**).

/ Liver Imaging

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/ 肝脏 影像学检查

章节大纲：

图 39

肝胆期对比增强 T1 (**A**) 和弥散加权 (**B**) MR 图像显示较小无强化转移灶伴弥散受限（**B** 图箭头所示明亮信号）。

/ Take-Home Messages

- Ultrasound (US) is usually the first-- line imaging modality for the liver. Because of its wide availability and since focal and diffuse parenchymal lesions are common, US has an important role in liver imaging.
- Contrast-enhanced multiphasic CT and MRI (with unenhanced, arterial, portal and late phase acquisitions) are essential for the detection and further characterisation of focal liver lesions. Due to their characteristic perfusion patterns cysts, haemangiomas, and many other focal liver lesions may often be detected and diagnosed reliably.
- MRI is the most accurate imaging modality for the evaluation of both diffuse and focal liver disease. Beyond perfusion imaging, dedicated MR sequences including diffusion-weighted imaging as well as hepato-specific contrast materials (based on hepatobiliary excretion) enable interrogation of liver tissue by many different methods during the same examination, thus leading to improved detection and characterisation of hepatic pathologies as compared to US and CT.
- US, CT and MRI are all used to estimate the size and volume of the liver and its segments, especially with the assistance of automatic segmentation techniques.
- Interventional radiological procedures are complementary to more invasive technoiques in many instances. These include liver biopsy, biliary drainage and stent placement, TIPS, tumour ablation with thermal (radiofrequency, cryo- or laser-) ablation, as well as transarterial chemo- or radioembolisation.

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏影像学检查

/ 核心要点

章节大纲：

- 超声 (US) 通常是肝脏的一线影像学检查手段。由于普及性高，且局灶性和弥漫性肝实质病变较为常见，超声在肝脏影像学检查中发挥着重要作用。
- 对比增强多期 CT 和 MRI（采用平扫、动脉期、门静脉期和延迟期采集）对局灶性肝脏病变变的检出及进一步定性至关重要。由于囊肿、血管瘤等肝局灶性病变具有特征性灌注模式，常能被可靠地检出和诊断。
- MRI 是评估弥漫性和局灶性肝脏病变最准确的影像学检查手段。除灌注成像外，专用 MR 序列（包括弥散加权成像）以及肝特异性对比剂（基于肝胆排泄）可在同一检查中通过多种不同方法评估肝组织，因此与 US 和 CT 相比，可提高肝脏病变的检出率和定性准确性。
- US、CT 和 MRI 均用于估计肝脏及各肝段的大小和体积，尤其在自动分割技术的辅助下。
- 在许多情况下，介入放射手术可作为更具侵入性技术的补充手段。包括肝活检、胆道引流及支架置入、TIPS、热消融（射频、冷冻或激光消融）治疗肿瘤，以及经动脉化疗栓塞或放射栓塞。

References

1. Koh Dow-Mu, Ba-Ssalamah A, Brancatelli G et al: Consensus report from the 9th International Forum for Liver Magnetic Resonance Imaging: applications of gadoxetic acid-enhanced imaging. European Radiology 31, 5615–5628 (2021)
2. Ner E, Bali MA, Ba-Ssalamah A et al, ESGAR consensus statement on liver MR imaging and clinical use of liver-specific contrast agents. European Radiology volume 26, pages921–931 (2016)
3. Paulatto, L., Dioguardi Burgio, M., Sartoris, R. et al. Colorectal liver metastases: radiopathological correlation. Insights Imaging 11, 99 (2020).
4. Chenin, M., Paisant, A., Lebigot, J. et al. Cystic liver lesions: a pictorial review. Insights Imaging 13, 116 (2022).
5. Karaosmanoglu, A.D., Uysal, A., Karcaaltincaba, M. et al. Non-neoplastic hepatopancreatobiliary lesions simulating malignancy: can we differentiate?. Insights Imaging 11, 21 (2020).
6. Tan, G.X.V., Miranda, R. & Sutherland, T. Causes of hepatic capsular retraction: a pictorial essay. Insights Imaging 7, 831–840 (2016)
7. Claire E. Brookmeyer C, Bhatt S, Fishman EK et al, Multimodality Imaging after Liver Transplant: Top 10 Important Complications RadioGraphics 42 (2022)
8. Cunha GM, Fowler KJ, Roudenko A, et al: How to Use LI-RADS to Report Liver CT and MRI Observations. RadioGraphics 41 (2021)

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参考文献

章节大纲：

1. Koh Dow-Mu, Ba-Ssalamah A, Brancatelli G et al: Consensus report from the 9th International Forum for Liver Magnetic Resonance Imaging: applications of gadoxetic acid-enhanced imaging. European Radiology 31, 5615–5628 (2021)
2. Ner E, Bali MA, Ba-Ssalamah A et al, ESGAR consensus statement on liver MR imaging and clinical use of liver-specific contrast agents. European Radiology volume 26, pages921–931 (2016)
3. Paulatto, L., Dioguardi Burgio, M., Sartoris, R. et al. Colorectal liver metastases: radiopathological correlation. Insights Imaging 11, 99 (2020).
4. Chenin, M., Paisant, A., Lebigot, J. et al. Cystic liver lesions: a pictorial review. Insights Imaging 13, 116 (2022).
5. Karaosmanoglu, A.D., Uysal, A., Karcaaltincaba, M. et al. Non-neoplastic hepatopancreatobiliary lesions simulating malignancy: can we differentiate?. Insights Imaging 11, 21 (2020).
6. Tan, G.X.V., Miranda, R. & Sutherland, T. Causes of hepatic capsular retraction: a pictorial essay. Insights Imaging 7, 831–840 (2016)
7. Claire E. Brookmeyer C, Bhatt S, Fishman EK et al, Multimodality Imaging after Liver Transplant: Top 10 Important Complications RadioGraphics 42 (2022)
8. Cunha GM, Fowler KJ, Roudenko A, et al: How to Use LI-RADS to Report Liver CT and MRI Observations. RadioGraphics 41 (2021)

Test Your Knowledge

Liver Imaging

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肝脏影像学检查

章节大纲：

知识测试

/ Test Your Knowledge

<?> QUESTION

1 **Which of the following statements is correct ?**
(Several correct answers are possible)

- ☐ The Couinaud classification divides the liver into 6 segments
- ☐ Each liver segment is a functional unit
- ☐ Liver segments can usually be resected separately
- ☐ Liver segments cannot be identified with cross- sectional imaging

/ Liver Imaging

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/ 肝脏 影像学检查 / 知识测试

章节大纲：

<?> 问题

1 **以下说法正确的是?**
(可能有多个正确答案)

- ☐ Couinaud 分段法将肝脏分为 6 段
- ☐ 每个肝段都是一个功能单位
- ☐ 肝段通常可单独切除
- ☐ 横断面成像无法识别肝段

/ Test Your Knowledge

<?> ANSWER

1 Which of the following statements is correct ?
(Several correct answers are possible)

- ☐ The Couinaud classification divides the liver into 6 segments
- ■ Each liver segment is a functional unit
- ■ Liver segments can usually be resected separately
- ☐ Liver segments cannot be identified with cross- sectional imaging

CHAPTER OUTLINE:

/ 知识测试

章节大纲：

<?> 回答

1 以下说法正确的是?
(可能有多个正确答案)

- ☐ Couinaud 分段法将肝脏分为 6 段
- ■ 每个肝段都是一个功能单位
- ■ 肝段通常可单独切除
- ☐ 横断面成像无法识别肝段

/ Test Your Knowledge

<?> QUESTION

2 Which of the following statements regarding the hepatic blood supply is correct ?

The liver has

- ☐ a single blood supply and a common venous drainage system
- ☐ a dual blood supply and a common venous drainage system
- ☐ a single blood supply and a dual venous drainage system
- ☐ a dual blood supply and a dual venous drainage system

CHAPTER OUTLINE:

/ 知识测试

章节大纲：

<?> 问题

2 关于肝脏血供，以下说法正确的是？

肝脏有

- ☐ 单一血供和共同的静脉引流系统
- ☐ 双重血供和共同的静脉引流系统
- ☐ 单一血供和双重静脉引流系统
- ☐ 双重血供和双重静脉引流系统

/ Test Your Knowledge

<?> ANSWER

2 Which of the following statements regarding the hepatic blood supply is correct ?

The liver has

- ☐ a single blood supply and a common venous drainage system
- ■ a dual blood supply and a common venous drainage system
- ☐ a single blood supply and a dual venous drainage system
- ☐ a dual blood supply and a dual venous drainage system

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查 / 知识测试

章节大纲：

<?> 回答

2 关于肝脏血供，以下说法正确的是？

肝脏有

- ☐ 单一血供和共同的静脉引流系统
- ■ 双重血供和共同的静脉引流系统
- ☐ 单一血供和双重静脉引流系统
- ☐ 双重血供和双重静脉引流系统

/ Test Your Knowledge

<?> QUESTION

3 Which of the following statements regarding diagnostic hepatic imaging is correct ?

(Multiple correct answers are possible)

- ☐ US is usually indicated only after CT and MRI
- ☐ Dynamic, contrast – enhanced (multiphasic) CT is well suited to evaluate disturbances of the hepatic blood perfusion
- ☐ Compared with CT and contrast- enhanced US, MR imaging offers more options to detect and characterise liver nodules
- ☐ Semi-automated segmentation techniques can be used to estimate the volume of the liver or its individual segments using CT or MRI.

CHAPTER OUTLINE:

/ 知识测试

章节大纲：

<?> 问题

3 关于肝脏影像学诊断，以下说法正确的是？

（可能有多个正确答案）

- ☐ US 通常仅在 CT 和 MRI 之后进行
- ☐ 动态增强（多期）CT 非常适合评估肝脏血流灌注异常
- ☐ 与 CT 和超声造影相比，MR 成像为定位和定性肝脏结节提供了更多选择
- ☐ 半自动分割技术可用于通过 CT 或 MRI 估计肝脏或各个肝段的体积

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/ Test Your Knowledge

<?> QUESTION

4 Which of the following statements regarding invasive, image – guided procedures is correct ?
(Multiple correct answers are possible)

- ☐ Catheter angiography of the liver is mainly indicated for diagnostic purposes
- ☐ Transjugular portosystemic shunt (TIPSS) placement can be used to treat steato-hepatitis
- ☐ US-guided biopsy is usually done to distinguish hepatic cysts from haemangioma
- ☐ Percutaneous ablative treatment under imaging guidance can be used for treatment of small solitary hepatocellular carcinoma

CHAPTER OUTLINE:

/ 知识测试

章节大纲：

<?> 问题

4 关于影像学引导的侵入性手术，以下说法正确的是？
（可能有多个正确答案）

- ☐ 肝脏导管血管成像主要用于诊断目的
- ☐ 经颈静脉门体分流术 (TIPSS) 可用于治疗脂肪性肝炎
- ☐ US 引导下活检通常用于鉴别肝囊肿与血管瘤
- ☐ 影像学引导下经皮消融治疗可用于治疗小的孤立性肝细胞癌

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CHAPTER OUTLINE:

/ 知识测试

章节大纲：

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Test Your Knowledge

<?> QUESTION

5 Which of the following statements is correct ?

The most frequent malignant hepatic nodules are due to

- ☐ Hepatocellular carcinoma
- ☐ Lymphoma
- ☐ Haematogenous metastases
- ☐ Cholangiocarcinoma

Liver Imaging

CHAPTER OUTLINE:

肝脏影像学检查 / 知识测试

章节大纲：

<?> 问题

5 以下说法正确的是?

最常见的恶性肝结节是源于

- ☐ 肝细胞癌
- ☐ 淋巴瘤
- ☐ 血行转移瘤
- ☐ 胆管癌

/ Test Your Knowledge

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CHAPTER OUTLINE:

/ 肝脏 影像学检查 / 知识测试

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/ Test Your Knowledge

<?> QUESTION

6 Among the following, which is the most frequent hepatic benign lesion ?

- ☐ Hepatocellular adenoma
- ☐ Haemangioma
- ☐ Focal nodular hyperplasia
- ☐ Peliosis

CHAPTER OUTLINE:

/ 知识测试

章节大纲：

<?> 问题

6 以下哪种是最常见的肝脏良性病变？

- ☐ 肝细胞腺瘤
- ☐ 血管瘤
- ☐ 局灶性结节性增生
- ☐ 紫癜病

/ Test Your Knowledge

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CHAPTER OUTLINE:

/ 肝脏 影像学检查 / 知识测试

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- ☐ 局灶性结节性增生
- ☐ 紫癜病

/ Test Your Knowledge

<?> QUESTION

7 Among the following, which statement is correct ?

On dynamic (multiphasic) CT, hepatocellular carcinoma (HCC) is best visualised

- ☐ in the arterial phase
- ☐ in the portal venous phase
- ☐ in the late (parenchymal) phase
- ☐ on unenhanced images, due to a central calcification

CHAPTER OUTLINE:

/ 知识测试

章节大纲：

<?> 问题

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在动态（多期）CT 上，肝细胞癌 (HCC) 显影最佳的是

- ☐ 动脉期
- ☐ 门静脉期
- ☐ 晚期（实质期）
- ☐ 平扫图像因中心钙化显示

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Test Your Knowledge

<?> QUESTION

8 Among the following, which statement is/are correct ?
(Multiple correct answers are possible)

In the presence of cirrhosis, the appearance of the liver at US can include the following:

- ☐ A fine, granular appearance of the parenchyma
- ☐ Decreased organ size
- ☐ Irregular liver contours
- ☐ Enlarged caudate lobe caudate

CHAPTER OUTLINE:

肝脏影像学检查 / 知识测试

章节大纲：

<?> 问题

8 以下说法正确的是？
（可能有多个正确答案）

存在肝硬化时，US 检查中肝脏的表现可能包括以下特征：

- ☐ 肝实质呈细颗粒样
- ☐ 肝脏体积缩小
- ☐ 肝脏轮廓不规则
- ☐ 尾状叶增大

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CHAPTER OUTLINE:

/ 肝脏 影像学检查 / 知识测试

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/ Test Your Knowledge

<?> QUESTION

9 Among the following, which statement is/are correct ?

(Multiple correct answers are possible)

- ☐ Liver steatosis can be detected in early stages by US
- ☐ Focal sparing in a steatotic liver can mimic a tumour on US
- ☐ MRI can be used to distinguish between focal steatosis and neoplastic nodules
- ☐ Both CT and MRI can provide semiquantitative data on steatosis

CHAPTER OUTLINE:

/ 知识测试

章节大纲：

<?> 问题

9 以下说法正确的是?

（可能有多个正确答案）

- ☐ 肝脂肪变性在早期可通过 US 检出
- ☐ 脂肪变性肝脏中的局灶性脂肪缺失在 US 上类似于肿瘤
- ☐ MRI 可用于鉴别局灶性脂肪变性和肿瘤性结节
- ☐ CT 和 MRI 均可提供关于脂肪变性的半定量数据

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CHAPTER OUTLINE:

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/ Test Your Knowledge

<?> QUESTION

10 Among the following, which statement regarding liver metastases is/are correct ? (Several correct answers possible)

- ☐ On US, liver metastases are most often hyperechoic
- ☐ On dynamic CT, liver metastases are usually best seen in the portal venous phase
- ☐ MRI with hepatobiliary contrast materials improves the conspicuity of liver metastases on T1-weighted late-phase parenchymal images
- ☐ Diffusion-weighted MRI, can be used to distinguish between liver metastases and benign liver nodules (based on ADC values)

/ Liver Imaging

CHAPTER OUTLINE:

/ 肝脏 影像学检查 / 知识测试

章节大纲：

<?> 问题

10 关于肝转移瘤，以下说法正确的是？（可能有多个正确答案）

- ☐ US 检查中，肝转移瘤最常表现为高回声
- ☐ 在动态 CT 上，肝转移瘤通常在门静脉期最清晰
- ☐ MRI 使用肝胆对比剂在 T1 加权晚期实质图像上改善了肝转移瘤的显影清晰度
- ☐ 弥散加权 MRI 可用于鉴别肝转移瘤与良性肝结节（基于 ADC 值）

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/ Liver Imaging

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