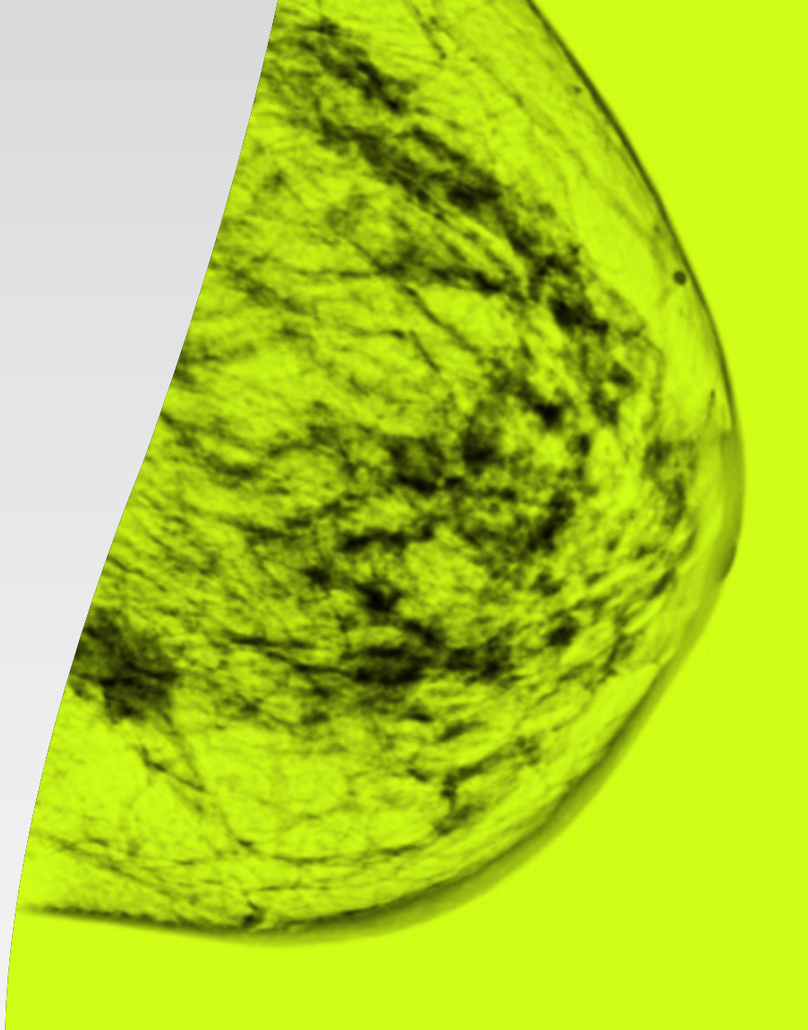
MODERN RADIOLOGY eBook

Breast Imaging

乳腺影像学



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

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

前言

*《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。

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章节大纲：

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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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Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

翻译致谢

本章节为《现代放射学电子书》的部分译文。

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乳腺影像学

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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。

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<-> CORE KNOWLEDGE

<!> ATTENTION

<↑> HYPERLINKS

>▪< FURTHER KNOWLEDGE

>|< COMPARE

<∞> REFERENCES

<?> QUESTIONS

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章节大纲：

/ 导示

<-> 核心知识

<!> 注意

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>▪< 进阶知识

>|< 比较

<∞> 参考文献

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MODERN RADIOLOGY eBook

Based on the ESR Curriculum for Radiological Education

Breast Imaging

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Breast Imaging

CHAPTER OUTLINE:

基于 ESR 课程的放射学教育

乳腺影像学

章节大纲：

乳腺影像学

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Chapter Outline

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

章节大纲

Breast Anatomy

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

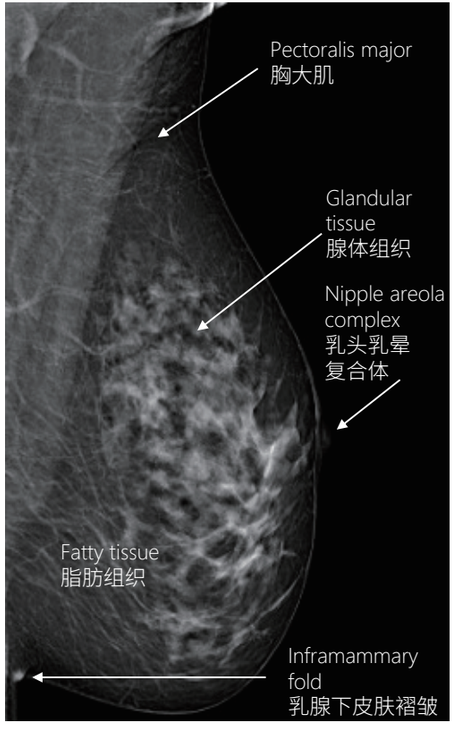
乳房解剖

/ Introduction

/ Female breasts are skin annexes, equal and symmetrical, with breastfeeding as their main function.

/ The breast is covered with skin, and at the apex it has a rounded pigmented area, the areola, in the center of which the nipple protrudes, resulting in the nipple areola complex (NAC).

/ Until puberty, the appearance and volume of the breasts are similar in both sexes. In women, when the breast develops, there can be notable variation in volume. Breast volume and texture are under the influence of genetic and endocrine stimuli. After puberty, in the male, the glandular part does not develop and, therefore, the breasts remain structurally in the prepubertal state for lifetime. In the female, at puberty, the breasts develop, with growth occurring by proliferation of all the components of the organ (parenchymal tissue, periductal stroma and interstitial connective tissue).



CHAPTER OUTLINE:

章节大纲：

/ 简介

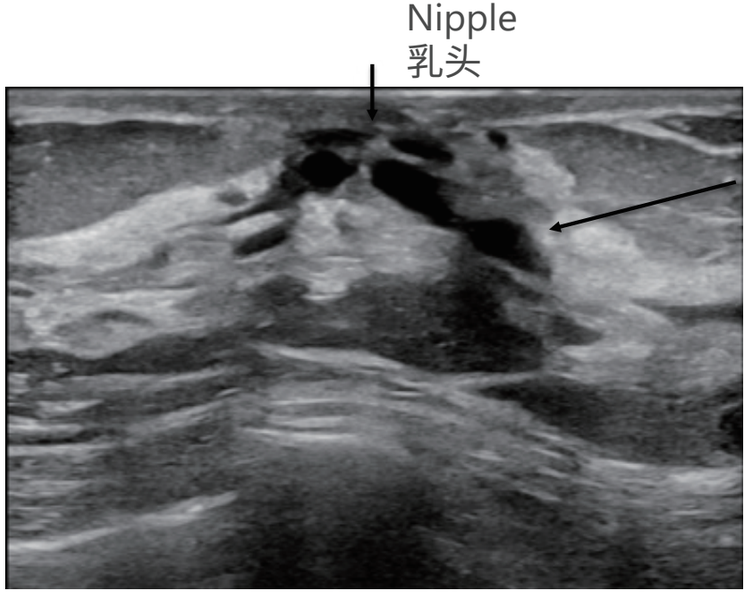
/ 女性乳房属于皮肤附属器官，大小一致，左右对称，主要功能为哺乳。

/ 乳房被皮肤覆盖，中央突起部位为乳头，在其周围色素沉着较深的环形区域，即为乳晕，两者构成乳头乳晕复合体 (NAC)。

/ 青春期前，男女乳房的外观和体积相似。当女性乳房开始发育后，体积会有较为明显的变化。乳房体积和质地受遗传和内分泌刺激的影响。青春期后，男性腺体不再发育，乳房在结构上终生处于青春期前状态。女性乳房在进入青春期后开始发育，随着各组织（实质组织、导管周围基质和间质结缔组织）增殖，逐渐发育成熟。

/ Nipple-Areola Complex

Ultrasound (US) anatomy of the confluence of the ducts in the nipple areola complex in a normal breast. The ducts are identifiable as anechoic tubular structures that are oriented towards the nipple.



/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 乳头乳晕复合体

正常乳房乳头乳晕复合体导管汇合处的超声 (US) 解剖。导管通常呈现为无回声管状结构，朝向乳头。

/ Breast Density

Breast density is due to fibroglandular tissue. This varies during the menstrual cycle due to proliferation of the epithelial cells and increased vascularity.

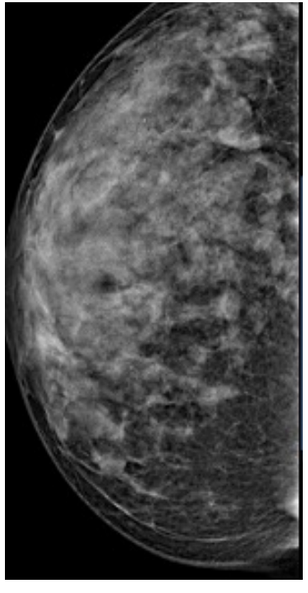
There is an increase in volume in pregnancy due to the development of the alveoli and related ducts.

At menopause, the glandular component of the breasts undergoes atrophy, while the connective support structures tend to relax. Hormone replacement therapy can increase breast density or prevent involution of breast glandular tissue.

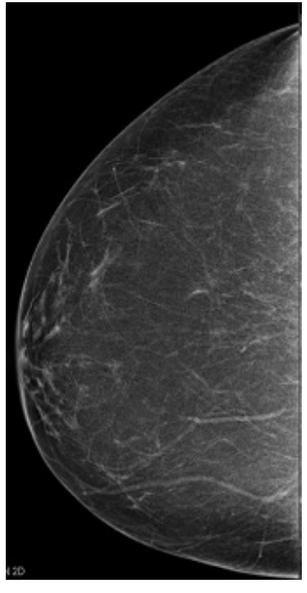
<!> ATTENTION

The quantity of glandular and connective components is classified on mammography by the ACR BI-RADS[1] into 4 categories:

a: almost entirely fatty
b: scattered areas of fibroglandular density
c: heterogeneously dense
d: extremely dense



Extremely dense
极度致密型



Almost entirely fatty
几乎全是脂肪

/ Breast Imaging

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/ 乳腺影像学

章节大纲：

/ 乳腺密度

乳腺密度反映了纤维腺体组织量。月经周期中，由于上皮细胞增殖和血供增加，乳腺密度会发生一定的变化。

妊娠期间，由于腺泡和相关导管的发育，乳房体积会明显增大。

绝经后，乳房腺体出现萎缩，结缔组织的支撑结构趋于松弛。激素替代疗法可增加乳腺密度或防止乳腺组织退化。

<!> 注意

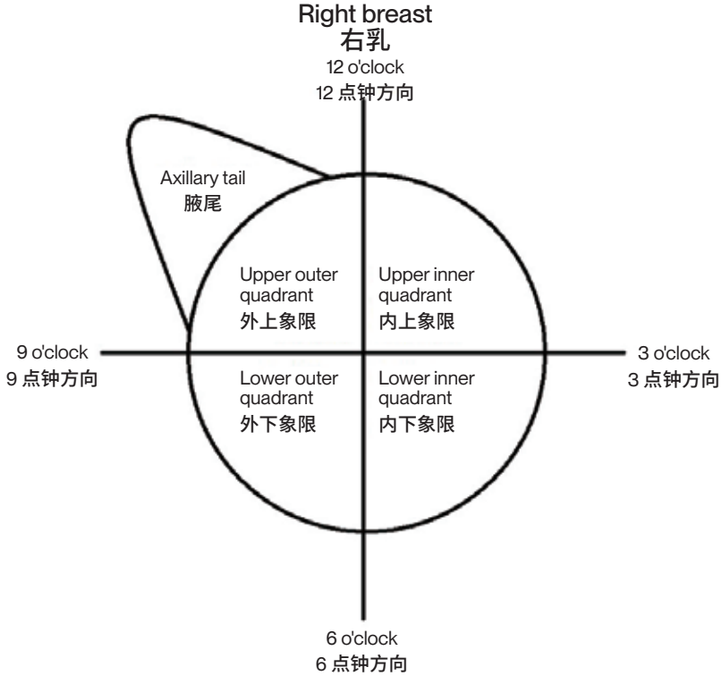
在乳腺 X 线摄影检查中，ACR BI-RADS[1] 依据腺体和结缔组织含量分为以下 4 类：

a 型：脂肪型
b 型：散在纤维腺体致密型
c 型：不均质致密型
d 型：极度致密型

/ Quadrant Anatomy

Two perpendicular axes passing through the nipple divide the breast into four quadrants.

The axillary tail is added adjacent to the upper-external quadrant. Furthermore, the hours of the clock can be used to locate any focal lesion, adding the distance to the nipple, as shown in the figure.



<!> ATTENTION

The upper-outer quadrant is the one with the largest amount of glandular tissue and, therefore, is more frequent site of breast cancer.

/ Breast Imaging

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/ 乳腺影像学

章节大纲：

/ 象限解剖

以乳头为中心，相互垂直的两根线将乳房分成四个象限。

腋尾是指乳房外上象限接近腋窝的部位。此外，钟面定位可用于定位任何局灶性病变，并测量其距乳头的距离，如图所示。

<!> 注意

由于外上象限的腺体组织相对丰富，乳腺癌常发生于该区域。

/ Structure: Lobes and Lobules

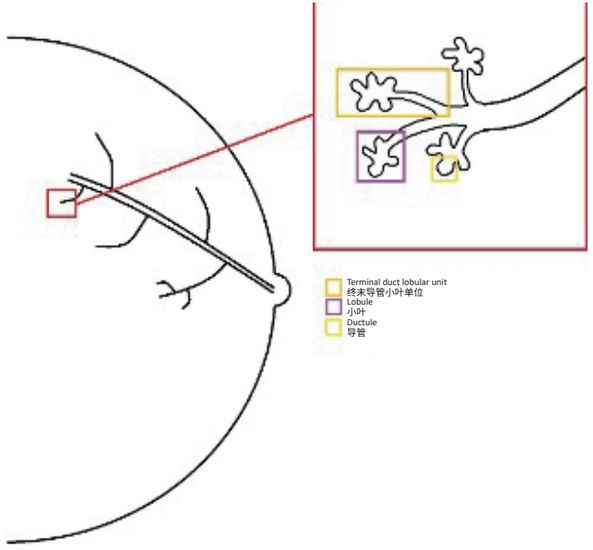
The breast contains glandular, fatty and connective tissue.

The glandular tissue (a modified apocrine gland) is divided in lobules, and produces the milk, which is drained by the mammary ducts to the nipple. The nipple areola complex (NAC) is part of the visible breast.

Connective bundles (retinacles) divide the glandular tissue into lobes and lobules.

Each breast has 12-20 lobes drained by a separate main duct per lobe.

Each lobe includes several lobules of glandular tissue, also referred as terminal ductal lobular units (TDLU) and mammary ducts carrying milk from lobules to the nipple.



<!> ATTENTION

TDLUs are epithelial structures that produces milk during lactation and are the main source of breast neoplasms precursors and cancers.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 结构：腺叶与小叶

乳房主要由腺体组织、脂肪组织和结缔组织组成。

腺体组织（一种特殊的顶泌腺）可分成若干个乳腺小叶，是分泌乳汁的部位，并由乳腺导管将乳汁引流到乳头。乳头乳晕复合体 (NAC) 是可见乳房的一部分。

结缔组织束 (retinacles)，将腺体组织分隔为多个腺叶和若干个乳腺小叶。

每侧乳房包含 12-20 个腺叶，每个腺叶由一个单独的主导管引流。

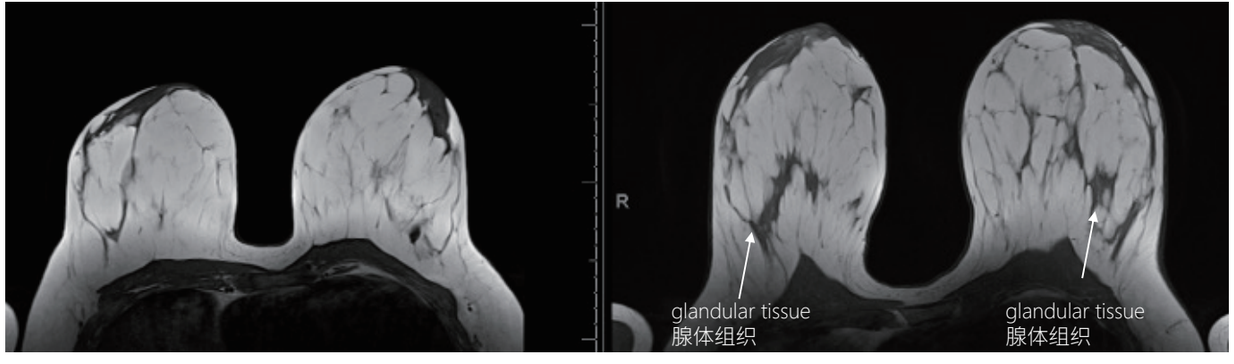
每个腺叶包含若干个腺体组织小叶（也称为终末导管小叶单位，TDLU），乳导管从小叶将乳汁运输到乳头。

<!> 注意

TDLU 是哺乳期分泌乳汁的上皮结构，也是乳腺肿瘤前病变和乳腺癌的主要起源部位。

Breast Anatomy During Pregnancy and Lactation

During the second month of gestation, the breasts grow due to lobular enlargement of the TDLUs and new TDLUs are formed. During the 3rd and 4th month of gestation the lobular glands distend even more, due to accumulation of secretions. Early lactation is accompanied by a further increase in the volume of the breasts, especially in the glandular component.



T1-weighted sequences before and during pregnancy in the same patient. There is an evident increase in volume and in the glandular tissue bilaterally.

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妊娠期与哺乳期乳房解剖

乳腺影像学

章节大纲：

妊娠第 2 个月时，TDLU 小叶膨大，同时新的 TDLU形成，乳房开始变大。妊娠第 3 个月和第 4 月时，由于分泌物的累积，小叶腺更进一步膨大。泌乳早期伴随着乳房体积的进一步增大，尤其是在腺体部分。

同一患者在妊娠前和妊娠期的 T1 加权序列。双侧乳房容量和腺体组织明显增大。

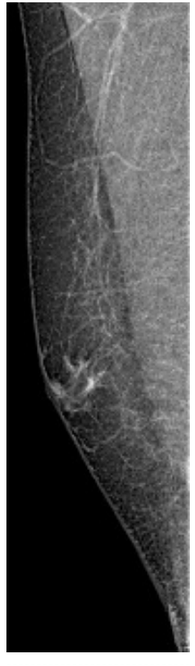
Male Breast: Anatomy and Gynaecomastia

In the male, the breast appear as a small, even and symmetrically located on the mid-clavicular line, at the level of the 4th intercostal space.

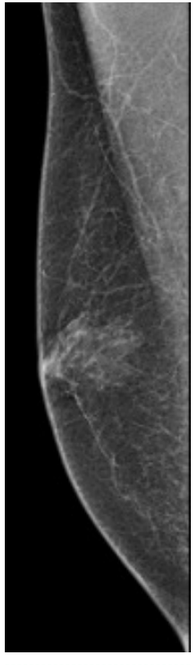
Structurally, the male breast is comparable to the female one before puberty. The glandular body is atrophic, in which the connective stromal tissue is dominant over the epithelial parenchyma.

At puberty, the male breast can undergo a temporary hypertrophy (**gynecomastia**), mostly unilateral, due to transient hormonal imbalance, with a prevalence of estrogen over androgens.

At older age gynaecomastia can develop due to the use of several drugs.



Normal male breast
正常男性乳房



Gynecomastia
男性乳房发育

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章节大纲：

男性乳房：解剖与男性乳房发育

男性乳房体积小且两侧均匀，对称地位于锁骨中线第 4 肋间隙水平。

从结构上看，男性的乳房与青春期前的女性基本相同。腺体萎缩，结缔基质组织占比超过上皮实质，占主导地位。

在青春期，由于一过性的激素失衡（雌激素水平高于雄激素），男性乳房可能会经历暂时性肥大（**男性乳房发育**），大多数为单侧乳房增大。

随着年龄增长，服用多种药物也可能会导致男性乳房发育。

Anatomical Variants

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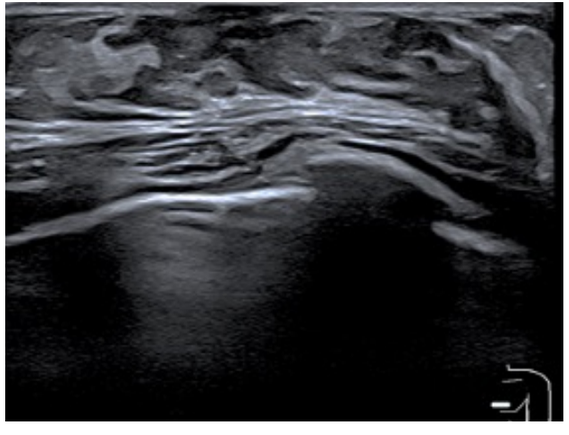
章节大纲：

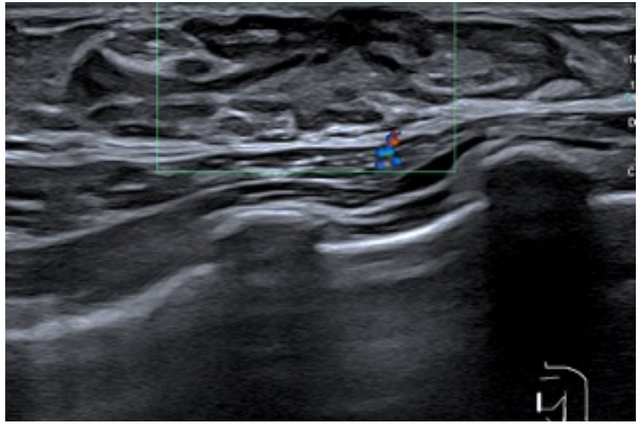
解剖变异

/ Normal Variations in Development

Premature thelarche: breast development < 7½ years, unilateral/bilateral, normal breast tissue on Ultrasound (US):

Idiopathic premature thelarche: 1-3 years old unusual after 4 years, self-limited.





Ultrasound of 3 years old girl in presence of palpable lump behind left nipple shows breast bud/ normal breast tissue in keeping wtih premature thelarche

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 发育正常变异

早熟性乳房发育：7 岁半前出现乳房发育，单侧/双侧，超声 (US) 可显示正常的乳腺组织：

特发性乳房早发育：1-3 岁，4 岁后不常见，自限性。

3 岁女孩，左侧乳头后方触及肿块，超声检查显示乳房芽/正常的乳腺组织，符合早熟性乳房发育

/ Gynecomastia

> excessive development of the breast tissue in male:

Physiologic:

/ In 90% of neonates transient breast hypertrophy due to maternal hormone

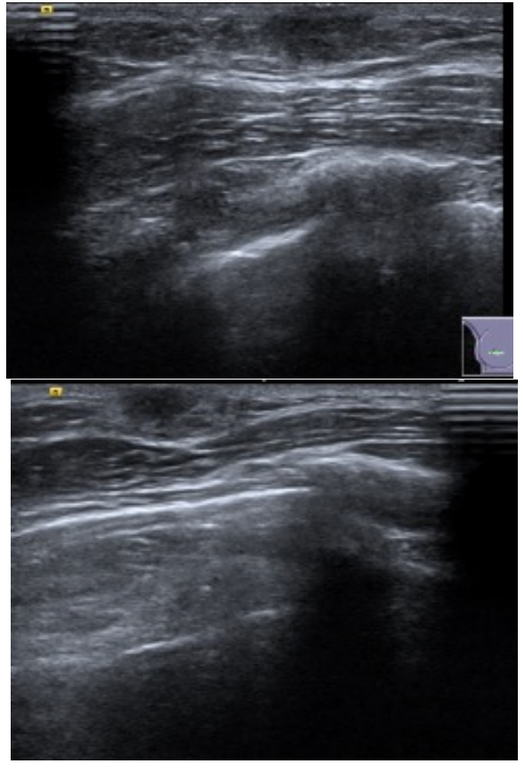
/ 1 year after puberty and for 1-2 years (75% healthy boys)

Further causes:

/ Anabolic steroids, digitalis, isoniazid, tricyclic antidepressants, marijuana

/ General obesity: pseudo gynecomastia

/ Klinefelter syndrome, anarchism, acquired testicular failure androgen receptor defects



Ultrasound shows typical US appearance of gynecomastia

/ Breast Imaging

/ 乳腺影像学

/ 男性乳房发育

> 男性乳腺组织过度发育：

生理性：

/ 90% 的新生儿因母体激素影响，引起暂时性乳房肥大

/ 青春期后 1 年，持续 1-2 年（75% 健康男孩）

其它原因：

/ 合成代谢类固醇、洋地黄、异烟肼、三环类抗抑郁药、大麻

/ 一般性肥胖：假性男性乳房发育

/ Klinefelter 综合征、无治主义、后天性睾丸衰竭、雄激素受体缺陷

超声检查显示典型的男性乳房发育的超声表现

/ Congenital and Developmental Abnormalities

Anomalous nipple and breast development:

- **Polythelia** > accessory nipples, most common
- **Polymastia** > accessory tissue incomplete involution of mammary ridge, usually enlarged during pregnancy and lactation
- **Amastia** > absence of breast development
- **Hyperplasia and Hypoplasia** > unilateral or bilateral
- **Congenital inversion of nipple** (3%) associated with duct ectasia, periductal mastitis
- **Ectopic breast tissue:** along the mammary ridge or milk line. Incomplete involution of ectodermal mammary ridge. Most common in the axilla (2-6% women)
- **Poland syndrome** > child born with missing or underdeveloped pectoralis muscle, breast hypoplasia or aplasia, rib and chest wall deformities, and ipsilateral limb abnormalities [rare 1/36.000-50.000]

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 先天性异常与发育异常

乳头和乳房发育异常：

- **多乳头** > 副乳头，最常见
- **多乳房畸形** > 乳腺嵴附属组织退化不完全，在妊娠期和哺乳期通常会增大
- **无乳房** > 乳房未发育
- **增生和发育不良** > 单侧或双侧
- **先天性乳头凹陷** (3%)，与乳腺导管扩张、导管周围乳腺炎相关
- **异位乳腺组织：**沿乳腺嵴或乳线分布。外胚层乳腺嵴退化不全。腋窝部位最常见（2%～6% 的女性）
- **Poland 综合征** > 儿童出生时胸肌缺失或发育不全、乳房发育不良或未发育、肋骨和胸壁畸形以及同侧肢体异常 [罕见，1/36000～50000]

Sternalis muscle:

/ Uncommon anatomic variant of the chest wall musculature.

<!> ATTENTION

/ Often cause of false positives in mammography.

Mammogram and MRI images of sternalis muscle

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

胸骨肌：

/ 胸壁肌肉的非典型解剖变异。

<!> 注意

/ 常导致假阳性乳腺 X 线摄影检查结果。

胸骨肌在乳腺 X 线和 MRI 上的表现

Pregnancy and Lactation

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

妊娠期与哺乳期

/ Pregnancy

Physiological changes in the architecture of the breast to prepare for breast feeding (increased serum level of oestrogen, progesterone and prolactin):

- **Marked ductal and lobular proliferation in early weeks of pregnancy**
- **Weeks 5-9** generalised breast enlargement and progressive increase in nipple-areolar complex pigmentation
- **First trimester** under the influence of oestrogen, ductal proliferation and growth, alveolar-lobular growth. Expansion of the glandular tissue results in invasion of adipose tissue, which progresses gradually, occurring simultaneous to increased vascularity and blood flow
- **Second half of pregnancy** hyperplasia, as well as the continuous involution of the fibrofatty stroma, colostrum accumulates in alveoli

<!> ATTENTION

As a result of these changes, the typical image of the breast at ultrasonography (US) is diffusely hypoechoic during pregnancy due to the increase in glandular tissue.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 妊娠期

乳房结构发生生理变化，为母乳喂养做准备（血清中雌激素、孕激素和泌乳素水平增加）：

- **在妊娠的最初几周，乳腺导管和小叶显著增生**
- **第 5-9 周**时，乳房体积整体增大，乳头乳晕复合体色素沉着逐渐明显
- **妊娠早期（前三个月）**受雌激素的影响，腺泡-小叶生长，导管增生与生长。腺体组织的扩张导致脂肪组织浸润，这一过程逐渐进行，与血管增加和血流量增加同时发生
- **妊娠后半期**增生，纤维脂肪基质持续退化，初乳在腺泡内积聚

<!> 注意

由于腺体组织的增加，上述变化导致妊娠期乳腺典型超声 (US) 表现为弥漫性低回声。

/ Partum

/ Post Partum

/ At the end of the pregnancy high levels of oestrogens and progesterone counteract prolactin, this inhibiting milk production, although colostrum production occurs in the alveolar cells.

/ **After delivery:** The reduction in oestrogen and progesterone levels results in the continuous release of prolactin, by hypothalamus, and the physical stimulation of the nipple by the new-born suction promotes the release of oxytocin by the anterior pituitary gland, in order to stimulate and maintain lactation.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 分娩

/ 产后

/ 尽管初乳在腺泡细胞中产生，但在妊娠末期，高水平的雌激素和孕激素对抗泌乳素，从而抑制乳汁的产生。

/ **分娩后：**雌激素和孕激素水平的降低导致下丘脑持续释放泌乳素，新生儿吸吮对乳头的物理刺激会促进垂体前叶释放催产素，以刺激并维持泌乳。

Breast Imaging

Lactogenesis > Conversion from a proliferative state during pregnancy to a secretory state during lactation.

/ The amount of milk produced **does not** correlate with the amount of glandular tissue, the number of ducts, or the mean duct diameter

/ Immediate post-partum enlargement due to colostrum accumulation

/ **3-7 days post partum** milk secreted into alveoli

/ Post-lactational changes: periductal perivascular stromal connective tissue increases

/ Alveolar cells and ductal branches regress

<!> ATTENTION

As a result of these changes, in ultrasonography (US) the typical image of the breast becomes diffusely hyperechoic during lactation, as a function of increased vascularity and prominence of the ducts.

乳腺影像学

泌乳 > 从妊娠期间的增殖状态转变为哺乳期的分泌状态。

/ 乳汁分泌量与腺体组织量、导管数量或平均导管直径无关

/ 由于初乳积聚，导致产后乳房急剧增大

/ 产后 3-7 天乳汁分泌到腺泡中

/ 哺乳后改变：导管周围血管周围间质结缔组织增加

/ 腺泡细胞和导管分支退化

<!> 注意

上述变化导致哺乳期乳腺典型超声图像转为弥漫性强回声，这是血供增加和导管突出所致。

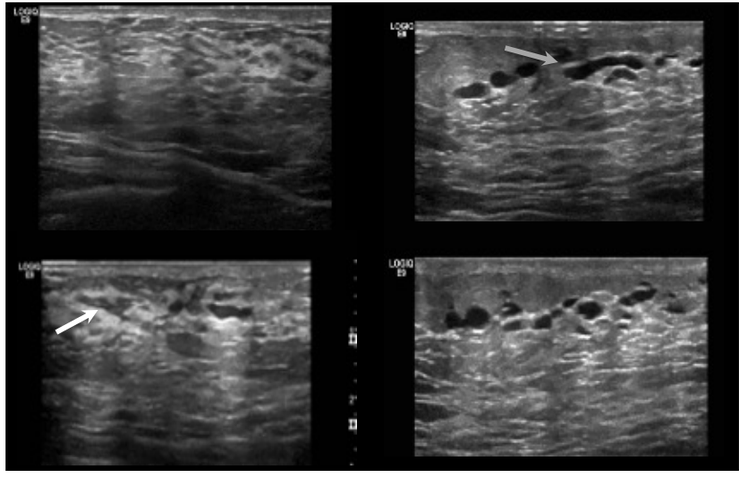
/ Lactation

Mammographic findings (for screening, wait 3 months after discontinuing lactation):

- / Diffuse increase in size and density
- / Little to no change to breast density

US Findings:

- / Increase in parenchymal echogenicity
- / Ductal ectasia
- / Increased vascularity



Ultrasound of breastfeeding woman. The B-mode US shows increased echogenicity pattern of the fibroglandular tissue, with bilateral dilated ducts (grey arrow). Some of them are filled with echogenic material (white arrow).

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 哺乳期

乳腺 X 线检查表现（待停止哺乳后 3 个月后进行筛查）：

- / 大小和密度弥漫性增加
- / 乳腺密度变化不大或无变化

超声检查表现：

- / 实质回声增强
- / 导管扩张
- / 血管增生

哺乳期妇女超声检查。B 超显示纤维腺体组织回声增强，双侧导管扩张（灰色箭头），其中部分导管充满了回声物质（白色箭头）。

Diagnostic Imaging Techniques

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

影像诊断技术

/ Diagnostic Imaging Techniques

The most important diagnostic imaging techniques used in breast radiology/imaging are:

- / Mammography
- / Digital Breast Tomosynthesis (DBT)
- / Ultrasound (US)
- / Magnetic Resonance Imaging (MRI)
- / Contrast-enhanced Mammography (CEM)

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

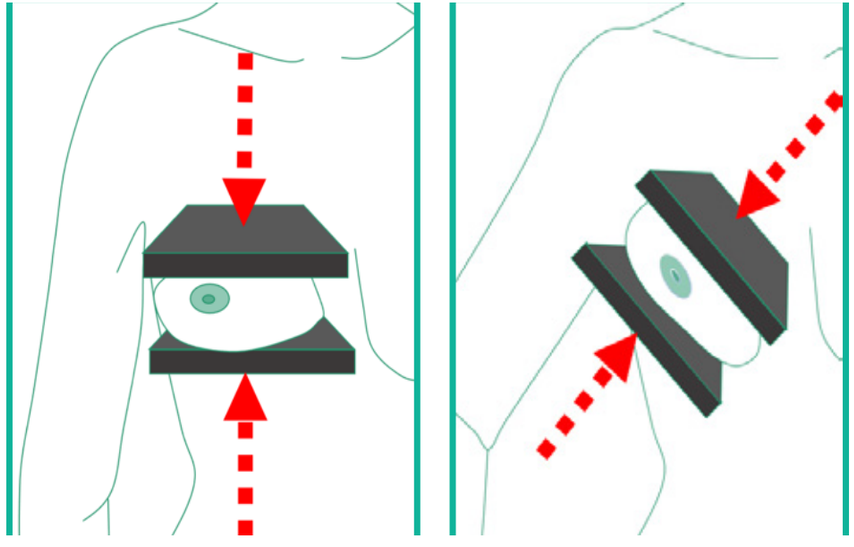
/ 影像诊断技术

乳腺放射/影像检查中最重要的影像诊断技术包括：

- / 乳腺 X 线摄影
- / 数字乳腺断层合成摄影 (DBT)
- / 超声 (US)
- / 磁共振成像 (MRI)
- / 对比增强乳腺 X 线摄影 (CEM)

/ Mammography

- **Mammography** is a radiographic technique specifically designed for breast imaging
- For the acquisition of **mammograms** – the images produced by mammography –, the breast is compressed in order to allow the dispersion of its components and facilitate their visualisation
- The standard mammographic views are the **craniocaudal (CC) and mediolateral oblique (MLO) views**



CC view

CC 位

MLO view

MLO 位

Orientation of the acquisition of the craniocaudal (CC) and mediolateral oblique (MLO) views.

/ Breast Imaging

CHAPTER OUTLINE:

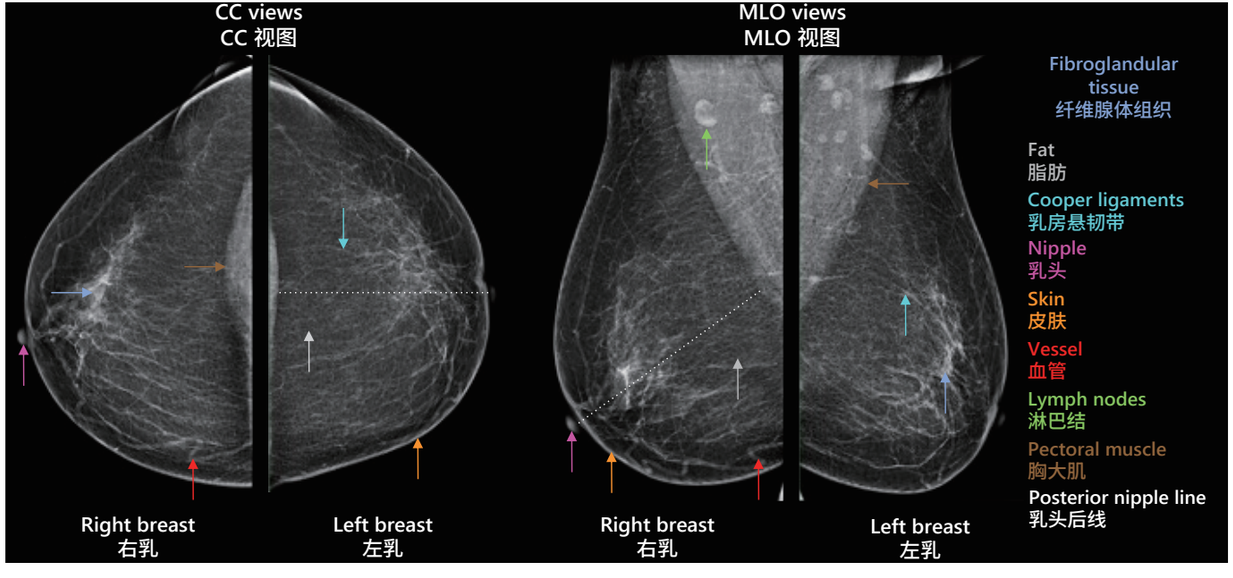
/ 乳腺 影像学

章节大纲：

/ 乳腺 X 线摄影

- **乳腺 X 线摄影**是一种专用于乳腺成像的放射成像技术
- 为采集**乳腺 X 线摄影图像**（由乳腺 X 线摄影生成的图像），对乳房进行挤压，使乳腺组织分散，提高图像清晰度
- 标准乳腺 X 线摄影视图为**头尾位 (CC) 和内外斜位 (MLO)** 视图

头尾位 (CC) 和内外斜位 (MLO) 视图的采集方向。



Breast anatomy as seen at normal mammography.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

正常乳腺 X 线摄影检查所见乳房解剖结构。

Principles

Quality criteria of adequate positioning for Mammography include:

CC views:

- Well-visualised posterior medial breast
- Pectoralis muscle should be demonstrated when possible
- If the pectoralis muscle is not included, the length of the posterior nipple line (PNL) – an imaginary line extending posteriorly and perpendicularly from the nipple to the pectoralis muscle – on CC and MLO views should be within 1 cm of each other
- Fat is seen posterior to the fibroglandular tissue
- Nipple in profile

MLO views:

- Pectoralis muscle extends inferior to the PNL
- Convex anterior border of the pectoralis muscle
- Pectoralis muscle is wider superiorly and narrows inferiorly
- Open inframammary fold
- Fat is seen posterior to the fibroglandular tissue
- Nipple in profile

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

原理

乳腺 X 线摄影正确体位质量标准如下：

CC 位：

- 后内侧乳房清晰可见
- 应尽可能显示胸大肌
- 若未包含胸大肌，则乳头后线 (PNL) 在 CC 位和 MLO 位上的长度差值应在 1 cm 范围之内（PNL 是指从乳头垂直向后延伸至胸大肌的虚拟连线）
- 可见纤维腺体组织后方的脂肪
- 乳头位于切线位

MLO 位：

- 胸大肌延伸至 PNL 下方
- 胸大肌前缘凸起
- 胸大肌上宽下窄
- 乳腺下皮肤褶皱打开
- 可见纤维腺体组织后方的脂肪
- 乳头位于切线位

Breast Imaging

- The **Average Glandular Dose (AGD)** = estimate of the average absorbed dose by the glandular breast tissue during Mammography measured in Gray (Gy):

$$AGD = K \times g \times c \times s$$

K: entrant surface air kerma
g: conversion factor for 50% glandular breast based on thickness and half-value layer
c: correction factor based on non-standard glandularity/thickness
s: correction factor based on non-molybdenum anode/filter combination

- AGD levels in Mammography are between 0,8 and 2,5 mGy for 4,5 cm PMMA (Polymethyl methacrylate) phantoms in clinical settings

- AGD levels in Mammography increase with increased breast thickness
- **Limiting AGD**: 3-4 mGy

乳腺影像学

- **平均腺体剂量 (AGD)** = 乳腺 X 线摄影中腺体组织吸收辐射剂量的平均估值，单位为戈瑞 (Gy)：

$$AGD = K \times g \times c \times s$$

K：入射表面空气比释动能
g：基于厚度和半值层的 50% 乳房腺体换算系数
c：基于非标准腺体占比/厚度的矫正系数
s：基于非钼阳极/滤过板组合的矫正系数

- 对于 4.5 cm PMMA（聚甲基丙烯酸甲酯）模体，在临床环境中，乳腺 X 线摄影 AGD 水平在 0.8 到 2.5 mGy 之间
- 乳腺 X 线摄影中 AGD 水平随乳房厚度的增加而增大
- **AGD 限值**：3-4 mGy

Breast Imaging

CHAPTER OUTLINE:

Main Indications

Screening Mammography:

/ Applied on asymptomatic women to identify breast cancer at an early/ potentially curable stage;

/ Starting from the age of 45-50 to the age of 70-74 depending on the country.

Diagnostic Mammography:

/ Applied on symptomatic patients or to work-up an abnormality found on Screening Mammography.

/ The standard mammographic views are supplemented with additional views (eg. lateral view, spot compression etc.) to further assess the screening-detected abnormality.

乳腺影像学

章节大纲：

主要适用范围

筛查性乳腺 X 线摄影：

/ 适用于无症状女性，在早期/可能治愈的阶段发现乳腺癌；

/ 从 45-50 岁起，截止到 70-74 岁，具体取决于所在国家/地区。

诊断性乳腺 X 线摄影：

/ 适用于有症状的患者，或对筛查性乳腺 X 线摄影发现的异常作进一步检查。

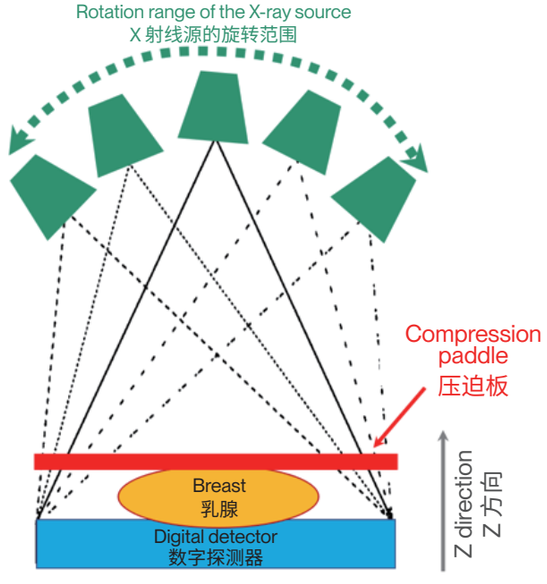
/ 标准乳腺 X 线摄影体位外，可补充其他体位（如侧位、点压等），以进一步评估筛查发现的异常情况。

/ Digital Breast Tomosynthesis (DBT)

>|< COMPARE

Principles/Relative Diagnostic Value/Main Indications

- **DBT** produces quasi-3D images of the breast, based on the reconstruction of several low-dose 2D-projections acquired in a limited range of x-ray tube angles.
- It reduces the burden of overlapping tissues in the evaluation of standard mammography and improves the detection and the delineation of findings, increasing the sensitivity and the specificity/ decreasing the false negatives and the false positives
- It is particularly useful in the detection and delineation of masses and architectural distortions and in the further evaluation of asymmetries.



The x-ray source rotates around the compressed breast within a limited range (green dashed line). Projection images are formed on the detector. These are then reconstructed through the breast volume along the Z direction.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 数字乳腺断层合成摄影 (DBT)

>|< 比较

原理/相对诊断价值/主要适应证

- DBT 根据 X 线球管在有限的角度范围内获得的多幅低剂量 2D 投影图像进行重建，生成乳房的类3D 图像。
- 这一成像技术可消除标准乳腺 X 线摄影评估中组织重叠的干扰，改善病变的检出和边界显示，并提高了灵敏度和特异性（减少假阴性和假阳性结果）
- 在肿块及结构扭曲的检出和边界显示，以及进一步评估不对称病变方面，优势尤为明显。

X 射线源在有限的角度范围内围绕被压迫的乳房旋转（绿色虚线）。在探测器上形成投影图像。然后沿 Z 方向进行全乳影像重建。

>|< COMPARE

Principles/Relative Diagnostic Value

/ DBT allows the production of **synthetic mammograms** – images similar in appearance to Digital Mammography (DM) that are generated based on the data acquired with DBT, without the need to further expose the breasts to additional radiation.

/ The radiation dose from DBT alone is currently similar or only slightly higher to that of DM.

<!> ATTENTION

DBT allows improved detection of architectural distortion in comparison to DM!

/ Breast Imaging

CHAPTER OUTLINE:

>|< 比较

/ 乳腺 影像学

章节大纲：

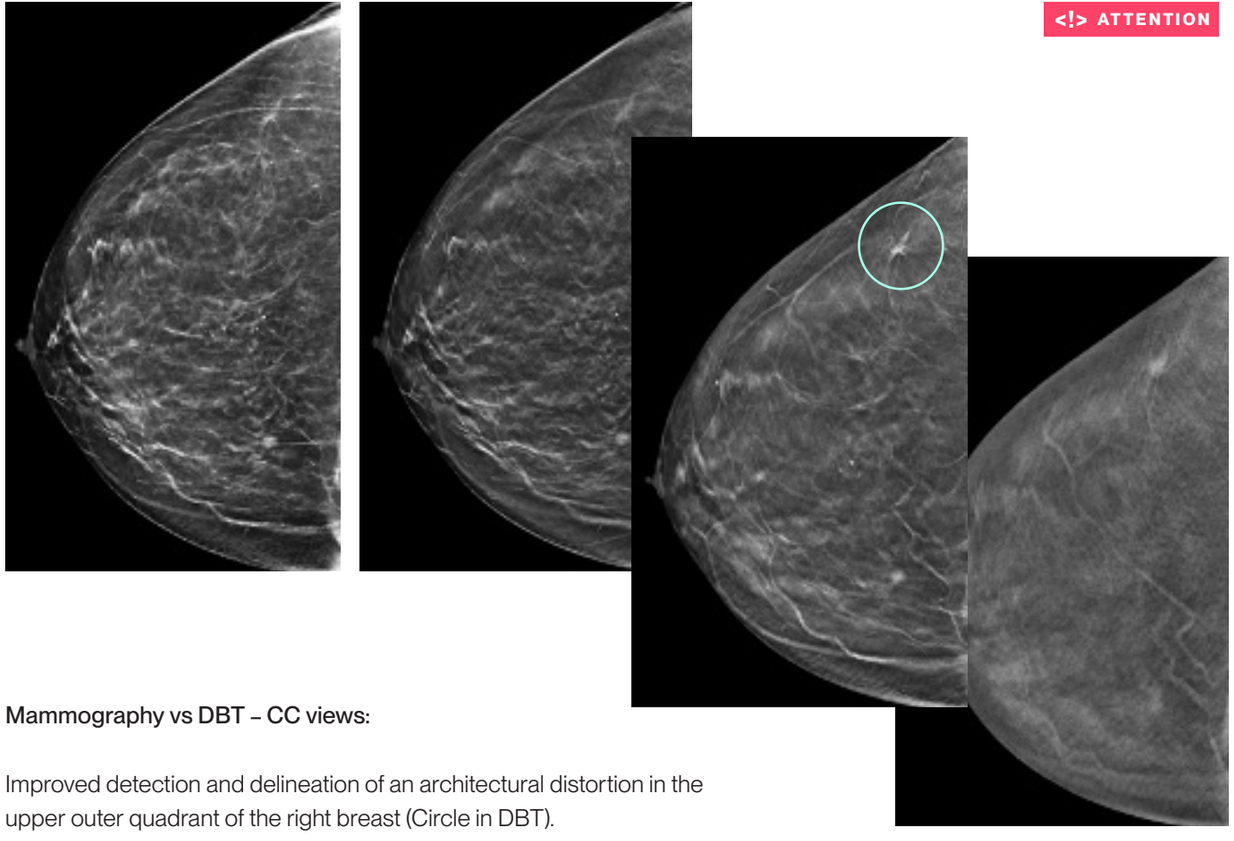
原理/相对诊断价值

/ 基于 DBT 数据可生成**合成乳腺 X 线摄影图像**，该图像可比肩数字乳腺 X 线摄影 (DM) 结果，无需重复 DM 检查，避免乳房额外辐射。

/ 目前，DBT 的辐射剂量接近或略高于 DM 的辐射剂量。

<!> 注意

与 DM 相比，DBT 能够更好地检测结构扭曲！



<!> ATTENTION

Mammography vs DBT – CC views:

Improved detection and delineation of an architectural distortion in the upper outer quadrant of the right breast (Circle in DBT).

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

<!> 注意

乳腺 X 线摄影与 DBT 比较 - CC 位：

改善了右乳外上象限结构扭曲的检出和边界显示（DBT 中圆圈所示）。

>|< COMPARE

Relative Diagnostic Value

Main disadvantages compared to Mammography

- Longer evaluation time – approximately 2 times more
- Artifacts:
  - Blurring (continuous image acquisition)
  - Motion (longer scanning time)

Breast Imaging

CHAPTER OUTLINE:

>|< 比较

乳腺影像学

章节大纲：

相对诊断价值

与乳腺 X 线摄影相比主要缺点

- 评估时间更长 - 约 2 倍以上
- 伪影：
  - 模糊（连续图像采集）
  - 移动（扫描时间较长）

Breast Imaging

CHAPTER OUTLINE:

Principles

/ **Breast density** refers to the relative amount of fibroglandular tissue comparing to fat in the breast.

<!> ATTENTION

/ The 5th edition of **BI-RADS (Breast imaging-reporting and data system)** classifies breast density according to four **descriptors** (see also page 10):

- / a: The breasts are almost entirely fatty;
- / b: There are scattered areas of fibroglandular density;
- / c: The breasts are heterogeneously dense, which may obscure small masses;
- / d: The breasts are extremely dense, which lowers the sensitivity of Mammography.

乳腺影像学

章节大纲：

原理

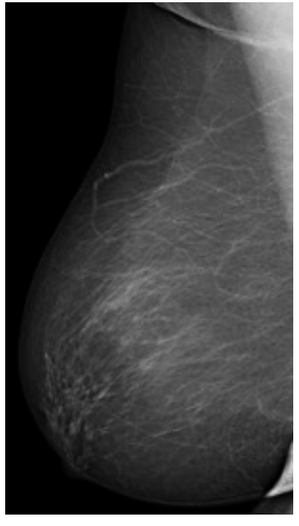
/ 乳房密度是指与乳房中的脂肪相比，纤维腺体组织的相对量。

<!> 注意

/ 第 5 版 BI-RADS（乳腺影像报告和数据系统）根据四种描述将乳腺密度分为以下分类（另见第 10 页）：

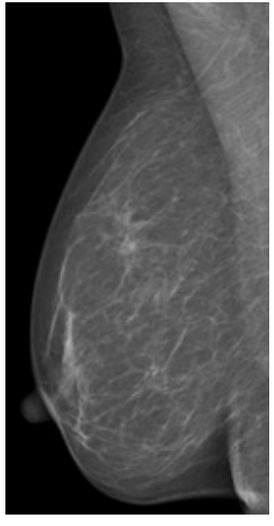
- / a：乳房内几乎全为脂肪组织；
- / b：纤维腺体密度呈区域性、分散存在；
- / c：乳腺组织不均匀致密，可能会掩盖小肿块；
- / d：乳腺组织极度致密，降低了乳腺 X 线摄影的敏感性。

>|< COMPARE



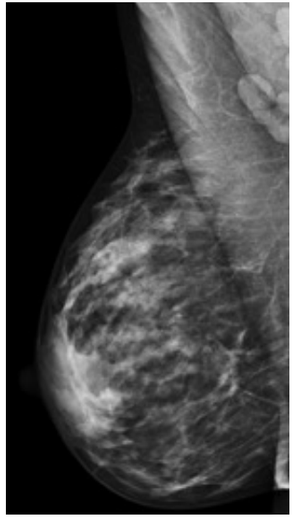
A

The breasts are almost entirely fatty



B

There are scattered areas of fibroglandular density



C

The breasts are heterogeneously dense, which may obscure small masses

D

The breasts are extremely dense, which lowers the sensitivity of Mammography

Breast density – Digital mammograms.

Breast Imaging

CHAPTER OUTLINE:

>|< 比较

乳腺影像学

章节大纲：

A

乳房内几乎全为脂肪组织

B

纤维腺体密度呈区域性、分散存在

C

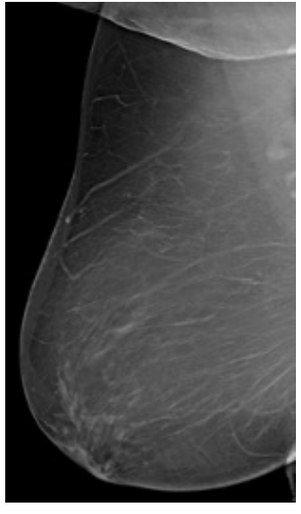
乳腺组织不均匀致密，可能会掩盖小肿块

D

乳腺组织极度致密，降低了乳腺 X 线摄影的敏感性

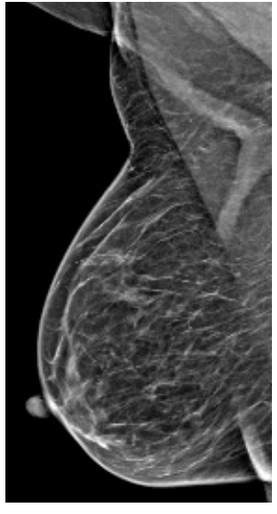
乳腺密度 - 数字乳腺 X 线摄影。

>|< COMPARE



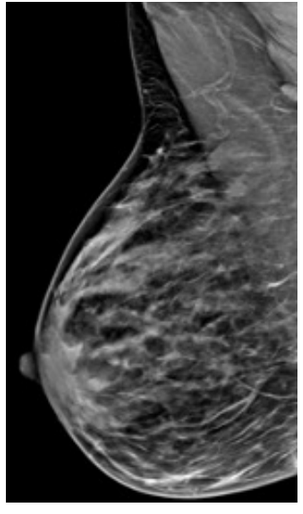
A

The breasts are almost entirely fatty



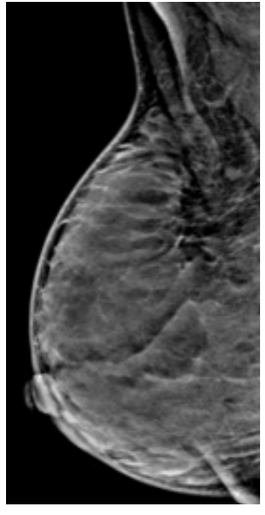
B

There are scattered areas of fibroglandular density



C

The breasts are heterogeneously dense, which may obscure small masses



D

The breasts are extremely dense, which lowers the sensitivity of Mammography

Breast density – Synthetic mammograms

Breast Imaging

CHAPTER OUTLINE:

>|< 比较

乳腺影像学

章节大纲：

A

乳房内几乎全为脂肪组织

B

纤维腺体密度呈区域性、分散存在

C

乳腺组织不均匀致密，可能会掩盖小肿块

D

乳腺组织极度致密，降低了乳腺 X 线摄影的敏感性

乳腺密度 - 合成乳腺 X 线图像

/ Ultrasound (US)

Breast US is an imaging technique that uses sound waves to visualise breast tissue:

/ The US transducer sends ultrasound pulses and receives echoes that contain spatial and contrast information regarding the tissues that are being scanned

>-< FURTHER KNOWLEDGE

/ It is recommended using high-frequency transducers, with a broad bandwidth operating at a centre frequency of at least 12 MHz and preferably higher

<!> ATTENTION

> See also eBook chapter on Ultrasound

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 超声 (US)

乳腺超声是一种利用声波来可视化乳腺组织的成像技术：

/ 超声传感器发送超声脉冲并接收回波，回波中包含了被扫描组织的空间和对比信息

>-< 进阶知识

/ 建议使用带宽较宽的高频探头，中心频率至少为 12 MHz，更高频率更佳

<!> 注意

> 另请参阅《超声》电子书章节

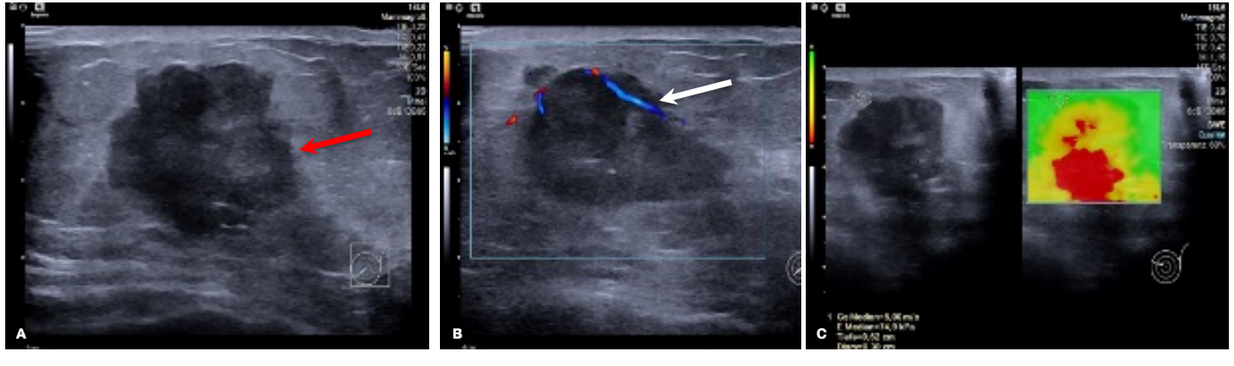
Breast US modalities include:

- **B-mode (Grey-scale)** – the standard modality
- **Doppler** – allows the evaluation of vascularisation (e.g., simple cysts – absent vascularity vs solid lesions –present vascularity)
- **Elastography** – allows the evaluation of stiffness (benign tumours – tend to be softer vs. malignant tumours – tend to be harder)

B-mode
B 型

Doppler
多普勒

Elastography
弹性成像



Breast US: B mode, Doppler and Elastography modalities revealing a biopsy-proven invasive breast cancer presenting as an irregular lesion (with microlobulated and angular margins, red arrow, A) heterogeneous hard mass exhibiting internal vascularity (white arrow, B) located in the inner quadrants of the left breast. Increased stiffness at elastography (C).

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

乳腺超声检查模式包括：

- **B 型（灰度）**- 标准模式
- **Doppler（多普勒）**- 可评估血管生成（例如，单纯性囊肿 - 缺乏血管结构 VS 或实性病变 - 存在血管结构）
- **弹性成像** – 可评估硬度（良性肿瘤 — 通常较软，而恶性肿瘤 — 通常较硬）

乳腺 US： B 型、多普勒以及弹性成像模式均显示了活检证实的浸润性乳腺癌，表现为不规则病变（微分叶及成角边缘，红色箭头，A）；位于左乳内象限的不均匀质硬肿块，具有内部血管结构（白色箭头，B）。弹性成像时硬度较高 (C)。

Relative Diagnostic Value

>|< COMPARE

MAIN ADVANTAGES:

+ Non-ionising radiation;
+ More available;
+ Less expensive.

MAIN DISADVANTAGES:

– "Operator dependence";
– Longer scanning time.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

相对诊断价值

>|< 比较

主要优势：

+ 非电离辐射；
+ 设备易于获得；
+ 费用较低。

主要缺点：

– "操作者依赖"；
– 扫描时间较长。

Main Indications

- Complementary assessment of findings detected by other imaging techniques (e.g., mammographically-detected masses and asymmetries, “second look” US after MRI).
- Evaluation of lymph nodes in level 1, 2 and 3 of the axilla.
- Evaluation of palpable abnormalities – direct real-time correlation of imaging and clinical findings:
  - Particularly in women with dense breasts (women with higher proportion of fibroglandular tissue) – Mammography is less sensitive.
- Evaluation of symptomatic young (usually < 30 years of age) or lactating and pregnant women.
- Guiding biopsies and other interventional procedures (e.g., aspiration of cysts, abscesses).

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

主要适用范围

- 对其他成像技术检出的结果进行补充性评估（例如，乳腺 X 线摄影检出的肿块和不对称，MRI 后“第二眼”US）。
- 评估腋窝淋巴结级别（1、2 和 3 级）。
- 评估可触及的异常 - 影像与临床直接的实时相关：
  - 尤其是致密型乳腺（纤维腺体组织比例较高的女性）–对乳腺 X 线摄影的敏感性较低。
- 评估有症状的年轻女性（通常 < 30 岁）或哺乳妇女和孕妇。
- 引导活检和其他介入治疗（如囊肿、脓肿抽吸）。

/ Magnetic Resonance Imaging (MRI)

Principles

/ Breast MRI is an imaging technique that exploits the magnetism of the protons that constitute the breast (and surrounding) tissues to create diagnostic images.

/ In simple terms, breast MRI results from this sequence of events

The patient lies on the MRI scanner table 〉 An emission antenna sends radiofrequency pulses to the body 〉 A receiving antenna – the breast coil – detects the signals emitted by the body 〉 The detected signals are processed and converted into images

<!> ATTENTION

> See also eBook chapter on Magnetic Resonance Imaging

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 磁共振成像 (MRI)

原理

/ 乳腺 MRI 是利用构成乳腺（及其周围）组织的质子磁性生成诊断图像的成像技术。

/ 简而言之，通过以下四个步骤即可得到乳腺 MRI 结果：

患者躺在 MRI 扫描台上 〉 发射系统向人体发送射频脉冲 〉 接收系统（乳腺线圈）检测人体发出的信号 〉 检测到的信号经过处理，转换为图像

<!> 注意

> 另请参阅《磁共振成像》电子书章节

The main sequences acquired in Breast MRI are:

- **T1-weighted sequences (T1W)** without and/or with fat saturation, before and after intravenous administration of gadolinium-based contrast agent – dynamic contrast-enhanced (DCE) imaging. > **Applications**: Anatomy evaluation; DCE - Assessment of vascularisation
- **T2-weighted sequences (T2W)** without and/or with fat saturation > Applications: Detection of fluid (cysts, oedema.) – high signal intensity; Evaluation of the ductal system – normally high signal intensity
- **Diffusion-weighted imaging (DWI)** > **Applications**: Further characterisation of findings by evaluating the motion of water molecules in tissues - in highly cellular tissues (vs low cellular tissues), such as malignant lesions, there is restriction of the diffusion of water molecules, which is translated as a lower diffusion coefficient (**hindered diffusion**) in the image

<!> ATTENTION

> See also eBook chapters on Magnetic Resonance Imaging and Contrast Agents

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

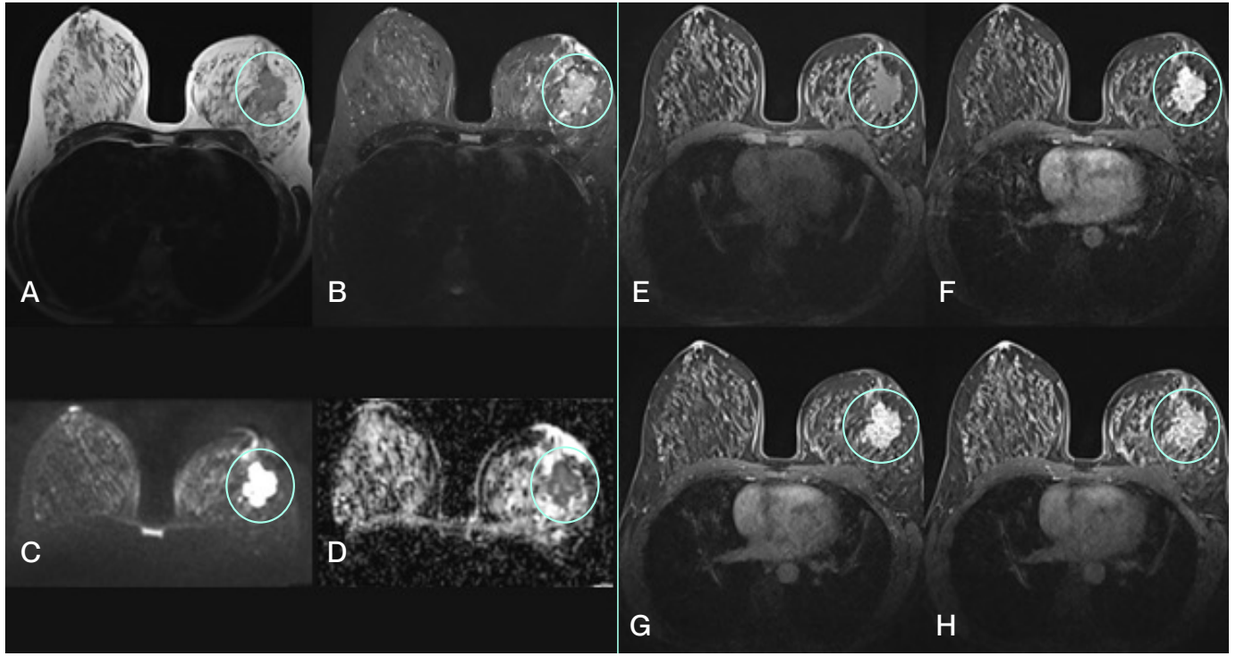
章节大纲：

乳腺 MRI 采集的主要序列为：

- **T1 加权序列 (T1W)**（无和/或有脂肪抑制），在静脉注射含钆对比剂前、后 - 动态对比增强 (DCE) 成像。> **应用**：解剖结构评估；DCE - 评估血管生成
- **T2 加权序列 (T2W)**（无和/或有脂肪抑制）> 应用：液体检测（囊肿、水肿）。- 高信号；导管系统评估 - 通常为高信号
- **弥散加权成像 (DWI)** > **应用**：通过评估组织中水分子的运动进一步表征发现 - 在细胞成分较高的组织（相对于细胞成分较低的组织）如恶性病变中，水分子的弥散受限，在图像中表现为较低的弥散系数（**弥散受阻**）

<!> 注意

> 另请参阅《磁共振成像与对比剂》电子书章节



Breast MRI: T2-weighted sequences – without (**A**) and with (**B**) fat saturation –, Diffusion-weighted imaging (**C**) with apparent diffusion coefficient (ADC) map (**D**) and T1-weighted sequences with fat saturation before (**E**) and after (F-H) intravenous administration of gadolinium-based contrast agent showing a biopsy-proven invasive breast cancer presenting as a mass with irregular margins located in the outer left breast quadrants (**green circle**) with heterogeneous internal enhancement (**H**) and perilesional oedema (**B**).

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

乳腺 MRI： T2 加权序列 - 无 (**A**) 和有 (**B**) 脂肪抑制 - 弥散加权成像 (**C**) 与表观扩散系数 (ADC) 图 (**D**)；T1 加权序列有脂肪抑制、静脉注射含钆对比剂前 (**E**) 和后 (F-H)；均显示了活检证实的浸润性乳腺癌，表现为位于左乳外象限、边缘不规则的肿块（**绿色圆圈**），具有不均匀内部强化 (**H**) 和病灶周围水肿 (**B**)。

Relative Diagnostic Value

>|< COMPARE

MAIN ADVANTAGES:

+ Non-ionising radiation
+ High sensitivity (up to 99%)
+ Superior soft-tissue contrast
+ Further characterisation of breast lesions by using morphological and functional information (DCE and DWI)

MAIN DISADVANTAGES:

– Less available
– More expensive
– Longer scanning times – motion artefacts
– Limited use in certain circumstances – e.g., claustrophobia and certain metallic devices

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

相对诊断价值

章节大纲：

>|< 比较

主要优势：

+ 无电离辐射
+ 高灵敏度（高达 99%）
+ 出色的软组织对比
+ 使用形态和功能性信息（DCE 和 DWI）进一步表征乳腺病变

主要缺点：

– 非普遍开展
– 费用昂贵
– 扫描时间较长 - 运动伪影
– 在某些情况下使用受限 - 如幽闭恐惧症和体内有金属植入物

Main Indications

- Breast cancer staging;
- Evaluation of response to neoadjuvant therapy;
- "Problem solving " (eg. Unclear findings in Digital Mammography, DBT and US; evaluation of suspicious nipple discharge);
- High-risk screening (eg. BRCA1 and BRCA2 mutations carriers);
- Screening of women with extremely dense breasts;
- Carcinoma of unknown primary (CUP) syndrome;
- Evaluation of breast implants.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

主要适用范围

- 乳腺癌分期；
- 新辅助化疗疗效评估；
- “解决问题”（例如，数字乳腺 X 线摄影、DBT 和 US 结果不清；可疑乳头溢液的评估）；
- 高风险筛查（如 BRCA1 和 BRCA2 突变携带者）；
- 乳腺极度致密的女性筛查；
- 不明原发肿瘤 (CUP) 综合征；
- 乳房植入物评估。

/ Contrast-Enhanced Mammography (CEM)

CEM is an imaging technique based on dual-energy mammographic acquisition after intravenous administration of an iodinated contrast agent; it highlights areas of increased contrast agent uptake:

Typically, 90-150 mL of an iodinated contrast agent is administered via a cannula placed in the antecubital fossa, followed by administration of 20 ml of saline solution at the same rate.

At least 120 seconds after the administration of the contrast agent, two images are produced for each compression/view:

- A **low energy image** (below the k-edge of iodine) – equivalent to a standard Digital Mammogram
- A **high energy image** (above the k-edge of iodine) and resulting recombined image – the background breast tissue is suppressed to highlight areas of increased contrast agent uptake

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 对比增强乳腺 X 线摄影 (CEM)

CEM 是一种以双能量乳腺 X 线摄影采集为基础，利用静脉注射碘对比剂的乳腺成像技术；可突出显示对比剂摄取增强的区域：

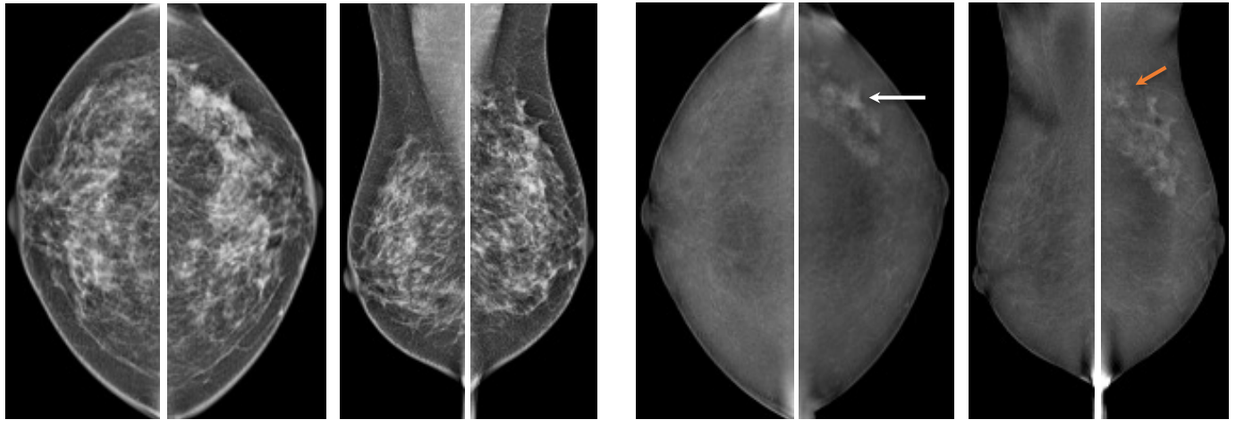
常规检查方式：通过置于肘前窝的套管针注射 90-150 mL 碘对比剂，然后以相同注射速率注入 20 mL 生理盐水溶液。

注射对比剂后至少等待 120 秒后进行操作，每次压迫/体位生成 2 张图像：

- **低能量图像**（低于碘的 k 边界）- 相当于标准数字乳腺 X 线照片
- **高能量图像**（高于碘的 k 边界）和生成的重建图像 - 抑制背景乳腺组织，以突出显示对比剂摄取增加的区域

Low energy images
低能量图像

Recombined images
重建图像



CEM: Low energy images show segmental pleomorphic microcalcifications in the upper outer quadrant of the left breast – further stereotactic-guided biopsy revealed Ductal Carcinoma in situ (DCIS); recombined images show coexistent but more extensive segmental clumped non-mass enhancement (white arrow), reaching the axillary tail (orange arrow).

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

CEM：低能量图像显示左乳外上象限存在节段样、多形性微钙化 - 进一步立体定位活检显示导管原位癌 (DCIS)；重建图像显示与钙化共存，但更广泛的段样分布集簇状非肿块强化（白色箭头），并延伸至腋尾（橙色箭头）。

Relative Diagnostic Value

/ CEM is more sensitive and specific than standard Digital Mammography due to the vascularity assessment.

/ Studies comparing CEM and Breast MRI have found similar sensitivities but variable specificities.

>|< COMPARE

MAIN ADVANTAGES:

compared to breast MRI

+ Lower cost
+ Shorter scanning times

MAIN DISADVANTAGES:

compared to breast MRI

– Limited Field of View (FoV) – cannot assess most of the axilla or chest wall
– Ionising radiation
– Adverse reactions to iodinated contrast agents

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

相对诊断价值

/ 由于可评估血运情况，CEM 比标准乳腺 X 线摄影的灵敏度和特异性更高。

/ 比较 CEM 与乳腺 MRI 的相关研究发现，两者具有相似的灵敏度，但特异性存在一定差异。

>|< 比较

主要优势：

与乳腺 MRI 相比

+ 成本更低
+ 扫描时间更短

主要缺点：

与乳腺 MRI 相比

– 视野 (FoV) 受限- 无法评估大部分腋窝或胸壁
– 电离辐射
– 碘化对比剂引起的不良反应

>|< COMPARE

Relative Diagnostic Value/Main Indications

The EUSOBI recommendations state that CEM can be considered as an alternative to Breast MRI for women with contraindications (eg. claustrophobia, metallic devices):

- Although investigation on Indications is still ongoing, they are generically similar to those of Breast MRI:
  - Breast cancer staging
  - Evaluation of response to neoadjuvant therapy
  - "Problem solving"

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

>|< 比较

相对诊断价值/主要适应证

EUSOBI 建议指出，对于 MRI 禁忌女性（如幽闭恐惧症、体内有金属植入物），可考虑将 CEM 作为乳腺 MRI 的替代诊断方案：

- 尽管对其适应证的研究仍在进行中，但与乳房 MRI 适应证大致相似：
  - 乳腺癌分期
  - 新辅助化疗疗效评估
  - “解决问题”

Diseases of the Breast: Benign

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

乳腺疾病：良性

/ Cysts

- Cysts are fluid-filled round or oval masses lined by epithelium.
- **Most common mass in female breast**, Can occur at any age; peak prevalence: 35-50 years.
- Patient can feel generalised or focal tenderness/ pain (↑ during premenstrual phase of cycle).
- Can be anywhere in breast, but very rare in the axilla.
- Simple cysts have **no malignant potential.**

Complicated breast cyst: contains intracystic echoes or debris with other features of a simple cyst

Complex breast cyst ("solid and cystic mass"): thick walled with thick septa or an intracystic solid mass, can have a malignant potential!

<!> ATTENTION

Cyst is the most common mass in the female breast.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 囊肿

- 囊肿为充满液体的圆形或椭圆形肿块，由上皮细胞包绕。
- **女性乳房中最常见的肿块**，可发生于任何年龄段；好发年龄：35-50 岁。
- 患者能感觉到全身或局部触痛/疼痛（月经前期↑）。
- 可以发生于乳房的任何部位，腋窝罕见。
- 单纯性囊肿**不具有潜在恶性。**

复杂性乳腺囊肿：囊内有回声或碎片，具有单纯性囊肿的其他特征

复合型乳腺囊肿（“囊实性肿块”）：厚壁。伴间隔较厚或囊内实性肿块，具有潜在恶性！

<!> 注意

囊肿是女性乳房中最常见的肿块。

/ Cysts – Imaging

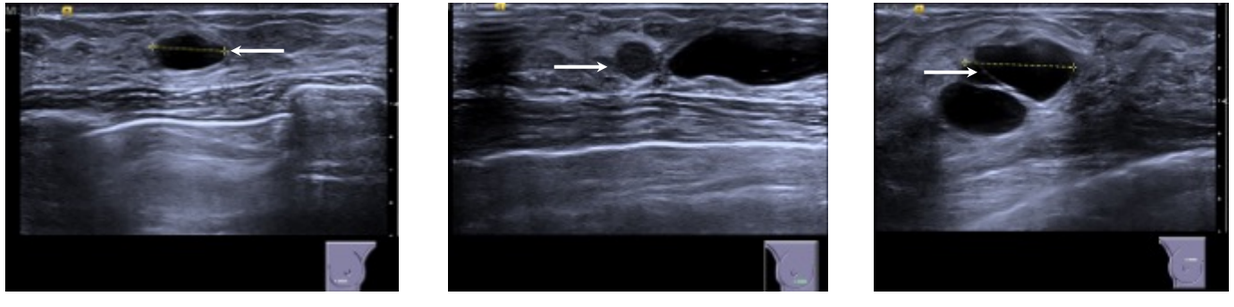
Best diagnostic tool is ultrasound (US).

- / Circumscribed, oval or round, anechoic mass with imperceptible wall and posterior enhancement
- / Can be deformable with transducer compression (not observed with solid masses)
- / Power or colour Doppler > Absent flow: Internal vascularity excludes simple cyst

<!> ATTENTION

US-guided fine-needle aspiration (FNA) is only useful in case of symptoms/signs of inflammation to reduce the symptoms as cysts can recur.

If a solid component is suspected, than prefer MRI and/or biopsy (core needle or vacuum assisted).



(**Left**) Ultrasound in a 35-year-old woman demonstrates an oval, circumscribed, anechoic mass with posterior enhancement ft (i.e., a simple cyst) in the left breast (left). Same patient has group of cysts with lobulated margin and internal debris debris (**middle**) and thin septations (**right**) in the right breast.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 囊肿 - 影像表现

超声 (US) 是理想诊断工具。

- / 肿块形态椭圆形或圆形，边缘清晰，无回声，壁厚不可见，后方回声增强
- / 探头挤压可轻微变形（不见于实性肿块）
- / 能量或彩色多普勒检查 > 无血流：内部血管结构排除单纯性囊肿

<!> 注意

鉴于囊肿可能会复发，超声引导下细针穿刺抽吸术 (FNA) 仅在出现炎症的症状/体征时使用，以缓解症状。

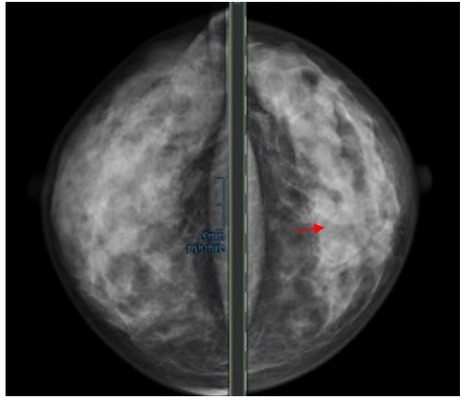
如果怀疑为实性成分，应首选 MRI 和/或活检（空芯针活检或真空辅助活检）。

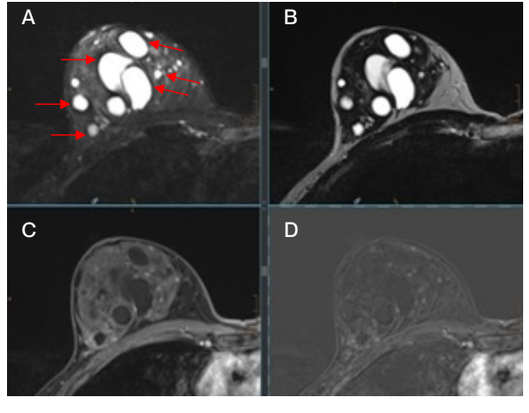
（左）一名 35 岁女性超声检查显示，左乳（左）内椭圆形肿块，边缘清晰，无回声，后方回声增强（即单纯性囊肿）。同一患者右乳有一组囊肿，边缘呈分叶状，内部有碎片（中）以及薄分隔（右）。

Mammography findings: Oval or round shaped, circumscribed or partially obscured mass. The density is lower or equal to breast parenchyma.

MRI Findings:

- **T1W:** Circumscribed, round or oval mass; low signal intensity (may have high signal if complicated).
- **T2W:** Homogeneously hyperintense, proteinaceous content > lower signal intensity.
- **T1W post-Gd:** No enhancement; imperceptible wall.





(**Left**) A 42-year-old woman noted a lump in her upper inner quadrant of left breast. On CC mammogram, the palpable finding was seen to correspond a large, partly obscured mass (**arrow**).

(**Right**) Axial STIR MR (**A**) (another patient) shows multiple (**arrows**), circumscribed, T2-hyperintense (**B**) oval masses due to simple cysts. Axial T1 C+ FS (**C**) and subtraction (**D**) MR shows nonenhancing cysts.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

乳腺 X 线摄影结果：肿块形态椭圆形或圆形，边缘清晰或部分被遮挡。密度低于或等于乳腺实质。

MRI 结果：

- T1W：肿块形态圆形或椭圆形，边缘清晰；低信号强度（若为复杂性囊肿，可能有高信号）。
- T2W：均匀高信号，含蛋白成分 > 较低信号强度。
- Gd 后 T1W：无增强；壁不可见

章节大纲：

（左）42 岁女性，发现左乳内上象限肿块。CC 位可见，可触及的肿块显示为较大肿块、部分边缘遮挡（箭头）。

（右）轴位 STIR MR(**A**) 显示（另一名患者），单纯性囊肿显示为多发圆形肿块（箭头），边缘清晰，T2 高信号 (**B**)。轴位 T1 C+ FS(**C**) 和减影 (**D**) MR 显示囊肿无强化。

/ Fibrocystic Changes

The term **fibrocystic changes (FCC)** indicates a spectrum of histopathologic benign changes of the female mammary gland including cysts, fibrosis, apocrine metaplasia, calcifications, inflammation, epithelial hyperplasia, and sclerosing adenosis (SA). FCC is **not as a disease but rather** a disorder of physiological development, maturation, and involution.

Most common symptom is **mastalgia** – focal or diffuse, particularly outer breasts, changes with menstrual cycle, more commonly in women with high amount of fibroglandular tissue.

More common in premenopausal women, trend to increase with nulliparity, and later menopause.

<!> ATTENTION

Fibrocystic changes can be proliferative or non-proliferative.

- **Nonproliferative FCC:** Periductal fibrosis, cysts, nonsclerosing adenosis are the most common findings in breast biopsies (70% of all cases). No increased risk of carcinoma.
- **Proliferative FCC:** Intraductal hyperplasia, sclerosing adenosis, radial scars, and papillomas are associated with a relatively increased risk of developing carcinoma in either breast (1.5-2.0x).

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 乳腺纤维囊性变

乳腺纤维囊性变 (FCC) 一词指的是一系列女性乳腺的组织病理良性改变，包括囊肿、纤维化、顶泌汗腺化生、钙化、炎症、上皮增生和硬化性腺病 (SA)。FCC **并非是一种疾病，而是**一种生理发育、成熟和退化过程的失常。

最常见症状是呈局灶性或弥漫性**乳腺痛**，尤其是乳房外侧，随月经周期而变化，更常见于纤维腺体组织含量高的女性。

在绝经前女性群体中更为常见，并在未产妇和绝经延迟女性人群中呈现出增加的趋势。

<!> 注意

乳腺纤维囊性变分为增生性或非增生性两类。

- **非增生性 FCC：**导管周围纤维化、囊肿、非硬化性腺病是乳腺活检中最常见发现（占所有病例的 70%）。不增加患癌风险。
- **增生性 FCC：**导管内增生、硬化性腺病、放射状疤痕和乳头状瘤与任一侧乳房发生癌变存在关联，风险增加 1.5-2.0 倍。

/ Fibroadenoma

Fibroadenoma (FA) is a common benign breast lesion resulting from excess proliferation of connective tissue. Fibroadenomas characteristically contain both stromal and epithelial cells.

- Most common solid mass in women of all ages (peak incidence 25-30 years)
- Most common sign: mobile, non-adherent palpable mass ±> tender
- Adult and juvenile ("cellular") types
- Natural history of FA to become sclerosed and calcify, involute spontaneously following menopause
- Follow-up to document possible growth is required at first sight, if the lesion diameter increases by more than 20 percent within 6 months and/or develops suspicious features, biopsy is recommended. If the biopsy result is equivocal or discordant, surgical excision is indicated

<!> ATTENTION

Fibroadenoma is the most common solid mass in women.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 纤维腺瘤

纤维腺瘤 (FA) 是一种由结缔组织过度增生引起的常见良性乳腺病变。纤维腺瘤通常同时包含基质细胞和上皮细胞。

- 各年龄段女性中最常见的实性肿块（25-30 岁发病率最高）
- 最常见的症状：活动性、无粘连性、可触及肿块±>触痛
- 成年和幼年（“细胞”）型
- FA 在绝经期后发生硬化、钙化及自发退化的自然病程
- 发现初期需要进行随访以记录可能的生长情况，若病变直径在 6 个月内增加超过 20% 和/或出现可疑特征，建议进行活检。如果活检结果不明确或不一致，则需进行手术切除。

<!> 注意

纤维腺瘤是女性最常见的实性肿块。

/ Fibroadenoma – Imaging

<!> ATTENTION

Best tool for symptomatic patients:
ultrasound if < 40y and mammography if > 40y, followed by US if needed.

>-< FURTHER KNOWLEDGE

Mammography:

- Oval or macrolobulated, **circumscribed** (can present a halo sign).
- Multiplicity/bilaterality may be more evident on DBT.
- Can have calcifications (**popcorn-shaped**), very dense or large; heterogeneous calcifications often gradually ↑ and coarsen as FA involutes.

US:

- Circumscribed, oval or gently lobulated, slightly hypo- to isoechoic mass with the long axis **parallel** to skin surface & the length:height ratio typically > 1.4 (mean: 1.8).
- Homogeneous, low-level internal echogenicity & echogenic calcifications ± shadowing.
- Doppler: Peripheral and feeding vessels common in juvenile fibroadenomas.

MRI:

- **T2W**: Myxoid FA and FA in young women usually ↑ T2 signal; After menopause, sclerosis and hyalinisation → ↓ T2 signal.
- **DWI**: Often bright with unhindered diffusion (high ADC).
- **Contrast-enhanced T1WI**: Oval or macrolobulated, circumscribed, enhancing mass.

PET CT:

- Common false-positive as most often FDG avid in Positron Emission Tomography.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 纤维腺瘤–影像表现

<!> 注意

有症状患者的最佳检查工具：
< 40 岁行超声检查；> 40 岁行乳腺 X 线摄影检查，必要时再行超声检查。

>-< 进阶知识

乳腺 X 线摄影：

- 椭圆形或伴大分叶状，边缘清晰（可见光环征）。
- 多区域/双侧性，在 DBT 中可显示更清晰。
- 可出现钙化灶（爆米花状），极度致密或较大；不均质钙化通常随着 FA 退化而逐渐↑和变粗。

US：

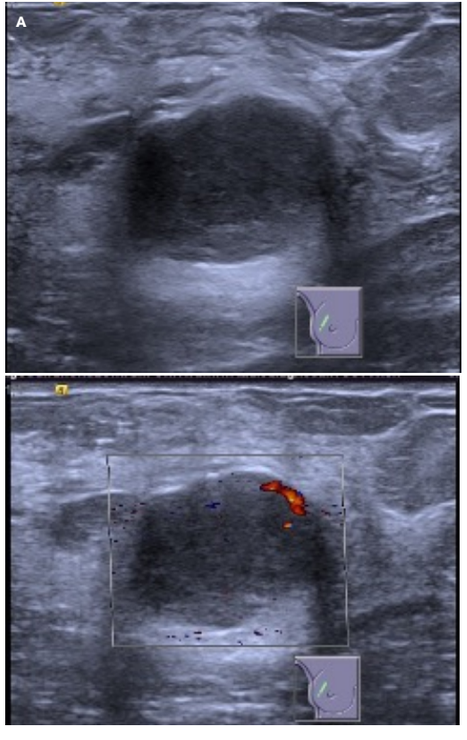
- 椭圆形或呈浅分叶状，边缘清晰，稍低回声至等回声，长径平行于皮肤表面，长高比通常 > 1.4（平均值：1.8）。
- 均匀、内部低水平回声和钙化回声 ± 声影。
- 多普勒：幼年型纤维腺瘤中常见周围血管和供血血管。

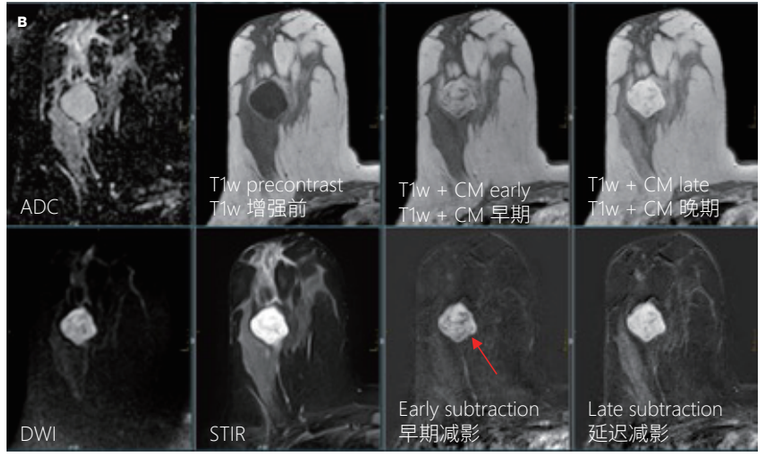
MRI：

- **T2W**：年轻女性 FA 和黏液样 FA 通常为↑T2 信号；绝经后，硬化和玻璃样变→↓T2 信号。
- **DWI**：通常高信号，弥散不受限（高 ADC）。
- **对比增强 T1WI**：肿块椭圆形或伴大分叶，边缘清晰，强化。

PET-CT：

- 常见假阳性，因为 PET 中常出现 FDG 摄取。





(A) 9-year-old woman had a palpable lump in upper outer right breast. Targeted US show a slightly lobulated, oval mass with mild posterior enhancement. Doppler US shows peripheral vascularisation.

(B) Representative axial multiparametric MRI of the right breast (same patient) shows large, enhancing (persistent signal increase), circumscribed, oval mass with dark internal septations (**arrow**).

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

(A) 9 岁女性右乳外上方有可触及肿块。靶向 US 可见椭圆形浅分叶肿块，后方回声轻度增强。多普勒超声显示，外周血管生成。

(B) 右乳（同一患者）代表性轴位多参数 MRI 显示较大肿块，可见强化（持续信号增强），形态椭圆形，边缘清晰，内部低信号分隔（箭头）。

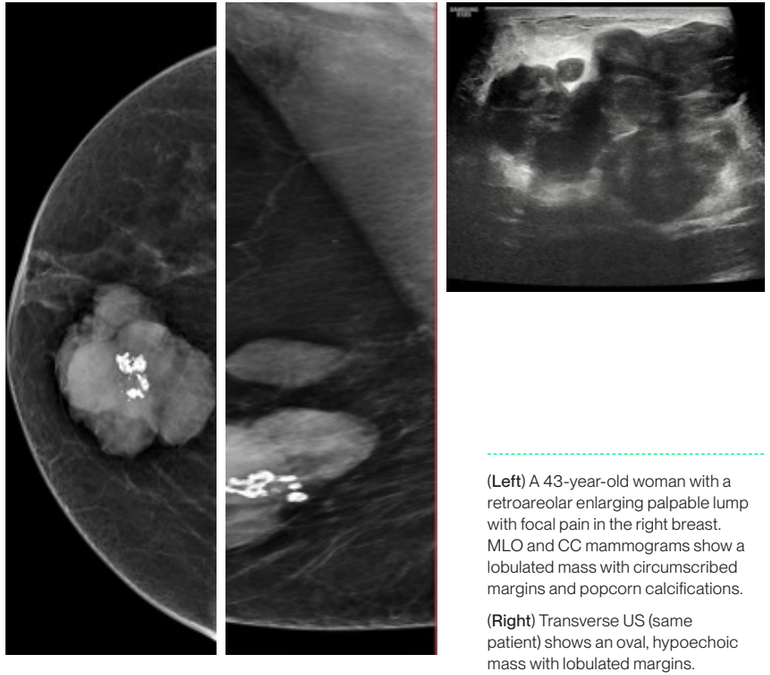
/ Phyllodes Tumour

Phyllodes tumour is a rare fibroepithelial tumour of the breast which **resembles fibroadenoma**.

It is typically a **large, fast growing** mass (3-5 cm at presentation) that forms from the periductal stroma of the breast.

Pathological distinction between fibroadenoma and phyllodes tumour is based on cellularity and overgrowth of stroma, margins, and mitotic figures.

- Imaging **cannot** reliably distinguish fibroadenoma from benign phyllodes tumour.
- Complete surgical excision is curative with wide local excision.



(**Left**) A 43-year-old woman with a retroareolar enlarging palpable lump with focal pain in the right breast. MLO and CC mammograms show a lobulated mass with circumscribed margins and popcorn calcifications.

(**Right**) Transverse US (same patient) shows an oval, hypoechoic mass with lobulated margins. Core biopsy ="fibroepithelial lesion." Excision = "benign PT" .

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 叶状肿瘤

叶状肿瘤是一种罕见的乳腺纤维上皮性肿瘤，**类似于纤维腺瘤**。

肿块通常**较大、生长快速**的肿块（出现时为 3-5 cm），由乳房的导管周围基质形成。

纤维腺瘤和叶状肿瘤之间的**病理区别**在于细胞结构和间质的过度生长、边缘和有丝分裂象。

- 影像学检查**无法**准确区分纤维腺瘤与良性叶状肿瘤。
- 局部扩大切除术可实现手术完全切除，达到根治。

（**左**）一名 43 岁女性右乳房乳晕后有增大的可触及肿块，伴有局部疼痛。MLO 和 CC 位乳腺 X 线片显示，肿块呈分叶状，边缘清晰，可见爆米花样钙化。

（**右**）横向 US（同一患者）显示，肿块形态椭圆形，低回声，边缘呈分叶状。空芯针活检= “纤维上皮病变” 。切除 = “良性 PT” 。

/ Hamartoma

Hamartoma, also known as fibroadenolipoma, is a **focal developmental malformation**. Usually circumscribed lesion with abnormal mixture of tissue elements or abnormal proportion of single element.

- Disorganised overgrowth of benign mammary tissue with normal differentiation of cells; variously ductal, lobular epithelium; stromal mesenchymal elements "breast within a breast"
- Type of biphasic breast **lesion**: contains integral epithelial and stromal components
- **Typically** benign finding, BI-RADS 2
- Core biopsy: Rarely indicated
- Usually asymptomatic, found on screening; can present as vague breast mass, can enlarge

<∞> REFERENCE

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4886616/

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 错构瘤

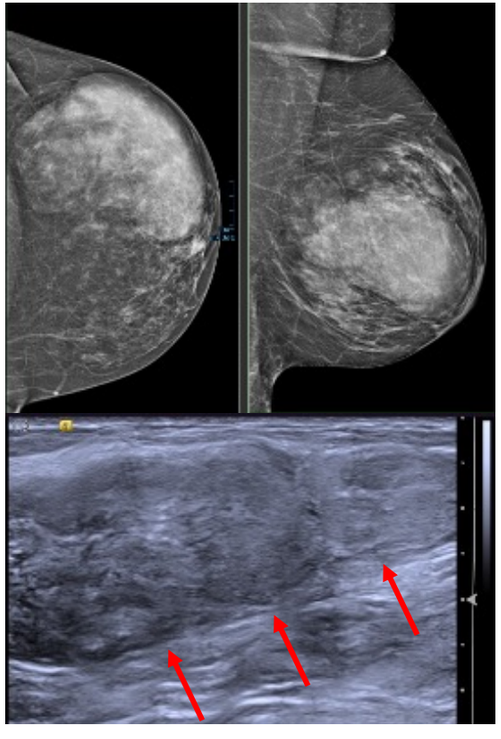
错构瘤（也称为纤维腺脂肪瘤）是一种**局灶性发育异常**。常为边缘清晰的病变，伴组织成分混合异常或单一成分比例异常。

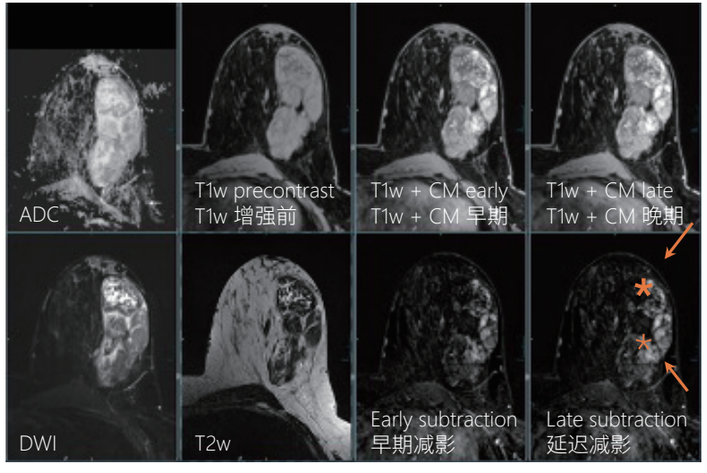
- 良性乳腺组织结构紊乱的过度生长，伴细胞正常分化；各种导管、小叶上皮及间叶间质成分"乳房内乳房"
- 双相乳腺病变型：包含完整的上皮和间质成分
- **通常**为良性，BI-RADS 2
- 空芯针活检：极少需要
- 通常无症状，在筛查时发现；可表现为不确切的乳房肿块，可增大

<∞> 参考文献

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4886616/

Hamartoma – Imaging





(**Left**) CC and MLO mammogram in a 41-year-old woman with asymmetric left breast shows a superficial 10-cm, oval, circumscribed mass. The mass is composed of mixed fat and fibroglandular elements surrounded by a pseudocapsule, consistent with hamartoma. US (same patient) shows a corresponding isoechoic oval mass with pseudocapsule (**arrows**).

(**Right**) MRI (same patient) performed to evaluate left breast mass showing a circumscribed, oval mass with persistent enhancing fibroglandular elements (**arrow**) and nonenhancing fat (**asterisk**).

Breast Imaging

CHAPTER OUTLINE:

错构瘤–影像表现

乳腺影像学

章节大纲：

（**左**）41 岁女性，左乳不对称。乳腺 X 线 CC 位和 MLO 位图像显示位于浅表层的 10 厘米肿块，椭圆形，边缘清晰。肿块由脂肪和纤维腺体成分混合组成，周围有假包膜，符合错构瘤特征。US（同一患者）显示，对应肿块形态椭圆形，等回声，周围有假包膜（**箭头**）。

（**右**）MRI 用于评估左乳肿块（同一患者），肿块形态椭圆形，边缘清晰，纤维腺体成分呈持续性强化（**箭头**），脂肪组织无强化（**星号**）。

/ Lipoma and Angiolipoma

Lipoma is a benign neoplasm composed of mature adipose cells.

Angiolipoma is a benign fatty neoplasm with capillary networks and fibrin thrombi.

Most common signs/symptoms:

- Slow-growing, freely movable, soft mass
- Subcutaneous lipomas more frequently palpable + painless
- Multiple lipomas may occur bilaterally in 3%

Angiolipoma: 5-17% of benign fatty tumours, more common in the upper extremities, abdomen, back

Differential Diagnosis:

- Benign Fat-Containing Lesions
  - Fibroadenolipoma (hamartoma)
  - Fat necrosis
  - Hibernoma
  - Cosmetic fat grafting or injections
- Liposarcoma and Atypical Lipoma

<!> ATTENTION

Lipoma is the most common soft tissue tumour in adults.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 脂肪瘤和血管脂肪瘤

脂肪瘤是一种由成熟脂肪细胞组成的良性肿瘤。

血管脂肪瘤是一种具有毛细血管网和纤维蛋白血栓的良性脂肪性肿瘤。

最常见体征/症状：

- 生长缓慢、活动性好、软组织肿块
- 皮下脂肪瘤常表现为可触及+无痛肿块
- 3% 的患者可能出现双侧多发性脂肪瘤

鉴别诊断：

- 含脂肪的良性病变
  - 纤维腺脂肪瘤（错构瘤）
  - 脂肪坏死
  - 棕色脂肪瘤
  - 美容脂肪移植或注射
- 脂肪肉瘤和非典型脂肪瘤

血管脂肪瘤：占良性脂肪肿瘤的5-17%，多见于上肢、腹部、背部

<!> 注意

脂肪瘤是成人最常见的软组织肿瘤。

Lipoma and Angiolipoma – Imaging

Mammographic Findings:

- **Lipoma:** Fat-only (radiolucent), **circumscribed**, oval or round mass;
  - **Mass effect** on surrounding tissue (displaces vessels, muscle, nodes).
- **Angiolipoma:** Circumscribed, fat-containing mass; may show soft tissue density due to capillary networks, fibrin thrombi.

US Findings:

- **Lipoma:** Circumscribed, oval or round mass;
  - Slightly **hyperechoic or isoechoic** to subcutaneous fat.
  - Compresses/displaces adjacent muscle, glandular tissue.
- **Angiolipoma:** Circumscribed **usually hyperechoic** mass, may have hypoechoic foci.
- **Both:** Little or no internal vascularity on Doppler.

MRI Findings:

- **Lipoma:** Circumscribed, T1-hyperintense, nonenhancing fatty mass.
- **Angiolipoma:** Circumscribed nonenhancing fatty mass, may contain hypointense foci on T1W & T2W sequences.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

脂肪瘤和血管脂肪瘤–影像表现

乳腺 X 线摄影：

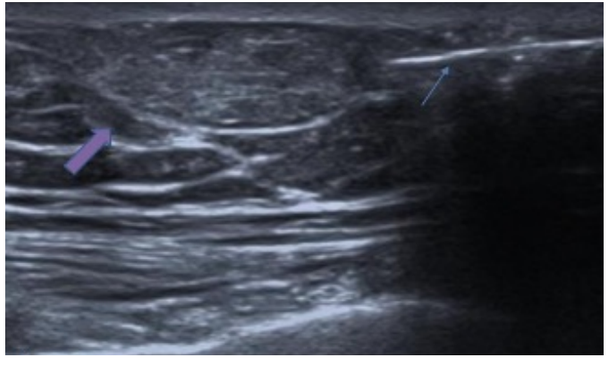
- **脂肪瘤：**肿块内仅含脂肪（X 线低密度），边缘清晰，形态椭圆形或圆形；
  - 对周围组织（血管、肌肉、结节移位）的**占位效应**。
- **血管脂肪瘤：**肿块边缘清晰，含脂肪；由于毛细血管网和纤维蛋白血栓，可能显示软组织密度。

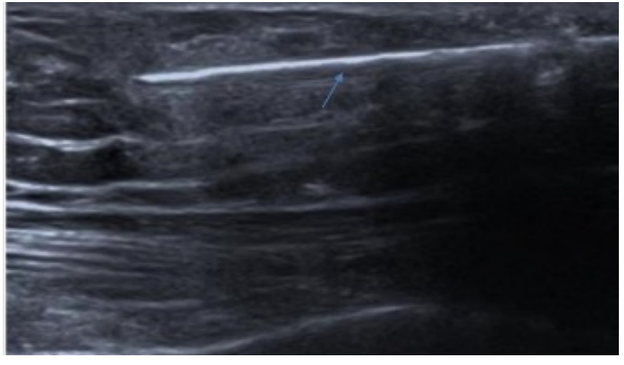
超声检查表现：

- **脂肪瘤：**肿块边缘清晰，形态椭圆形或圆形；
  - 皮下脂肪稍**高回声或等回声**。
  - 压迫/移位邻近肌肉、腺体组织。
- **血管脂肪瘤：**肿块边缘清晰，常为高回声，可有局灶性低回声。
- **两者共性：**多普勒检查显示，无内部血管结构或很少。

MRI 结果：

- **脂肪瘤：**肿块边缘清晰，T1 高信号，脂肪成分无强化。
- **血管脂肪瘤：**肿块边缘清晰，脂肪非强化，在 T1W 和 T2W 序列上可能含有局灶性低信号。





(**Left**) 39-year-old woman had a longstanding palpable lump in her right breast. US shows an elongated, oval, circumscribed mass (purple arrow) without internal vascularity,which was isoechoic or very slightly hyperechoic to the subcutaneous fat, consistent with benign lipoma. (**Right**) US-guided biopsy concordant.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

（左）39 岁女性患者，右乳可触及一个长期存在的肿块。US 显示，肿块细长，形态椭圆形，边缘清晰（紫色箭头），无内部血管结构，皮下脂肪呈等回声或极轻微的高回声，符合良性脂肪瘤特征。（右）超声引导下活检结果一致。

/ Mastitis

Mastitis = focal or diffuse breast inflammation, usually infectious. There are several distinct clinical entities:

- **Puerperal mastitis:** in lactating breast; bacterial; **responds well** to conservative treatment & oral antibiotics
- **Non-puerperal mastitis:** broad category of non-lactational bacterial infection; includes iatrogenic; often chronic, recurrent, refractory to conservative therapy; a special entity is granulomatous mastitis

- Most common **causative organisms**
  - Staphylococcus (aureus or epidermidis); methicillinresistant S. aureus (MRSA): more localised & invasive
  - Streptococcus: More diffuse; associated with cellulitis

- Most **common signs/symptoms**
  - Diffuse or focal pain/tenderness, erythema, edema, warmth
  - Palpable, tender lump (abscess, inflammatory mass)
  - ± nipple retraction, discharge, fever, leukocytosis

<!> ATTENTION

Treatment

- Oral systemic antibiotics & warm compresses, analgesics
- If symptoms do not resolve promptly, US should be performed to exclude abscess
  - If (+) abscess: US-guided aspiration > culture & sensitivity, pathogen-specific antibiotics
- Repeat aspiration may be necessary

<∞> REFERENCE

https://pmc.ncbi.nlm.nih.gov/articles/PMC4886616/

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 乳腺炎

乳腺炎 = 局灶性或弥漫性乳腺炎症，通常为感染性。疾病的主要临床分型：

- **产褥期乳腺炎**：哺乳期乳房；细菌性；保守治疗和口服抗生素**疗效良好**
- **非产褥期乳腺炎**：非哺乳期细菌感染的广义类别；包括医源性；通常为慢性、复发性，保守治疗无效；特殊类型为肉芽肿性乳腺炎。

- 最常见**致病微生物**
  - 葡萄球菌（金黄色葡萄球菌或表皮葡萄球菌）；耐甲氧西林金黄色葡萄球菌 (MRSA)：更具局部局限性及侵入性
  - 链球菌：弥漫性较强；与蜂窝织炎相关

- 最常见**体征/症状**
  - 弥漫性或局部疼痛/触痛、红斑、水肿、发热
  - 可触及的、触痛性肿块（脓肿、炎性肿块）
  - ± 乳头回缩、分泌物、发热、白细胞增多

<!> 注意

治疗

- 口服全身性抗生素、热敷、止痛剂
- 如果症状未迅速消退，应进行超声检查以排除脓肿
  - 如果 (+) 脓肿：超声引导下穿刺 > 细菌培养及药物试验，病原体特异性抗生素
- 可能需要重复活检

<∞> 参考文献

https://pmc.ncbi.nlm.nih.gov/articles/PMC4886616/

Mastitis/Abscess – Imaging

Mammographic Findings:

- Not routinely performed in puerperal mastitis (clinical diagnosis).
- Diffuse or focal: **↑ breast density, skin & trabecular thickening.**
- ± dilated subareolar ducts, may extend peripherally.
- Irregular mass: **Consider abscess** or nonbacterial mastitis.
- **Adenopathy** often present.

MRI Findings:

- T2W: **↑** T2 signal in areas of edema;
  - **Focal T2-hyperintense collection(s) suggest abscess.**
- T1W C+: Focal non-mass enhancement can be seen;
  - **Rim-enhancing** mass suggests abscess or malignancy.

US Findings:

- Diffuse or focal skin thickening, **↑ echogenicity due to edema**, ± hyperemia on Doppler.
- ± dilated lymphatics, intraductal debris, thickened duct walls.
- Possible fluid collection ± mobile echoes, fluid-debris level, thick wall: **Abscess.**
- Often reactive axillary nodes with diffusely thickened cortices.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

乳腺炎/脓肿–影像表现

乳腺 X 线摄影：

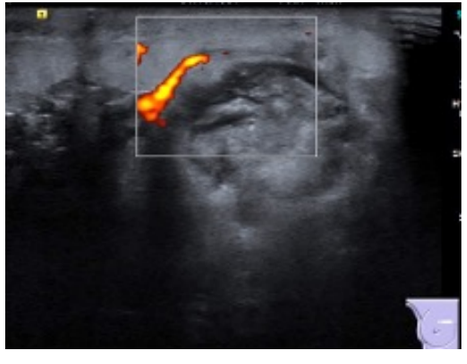
- 产褥期乳腺炎不作常规检查（临床诊断）。
- 弥漫性或局部：**↑ 乳腺密度、皮肤和小梁增厚。**
- ± 乳晕下导管扩张，可向周围延伸。
- 不规则肿块：**考虑脓肿或非细菌性乳腺炎。**
- 经常出现**淋巴结肿大。**

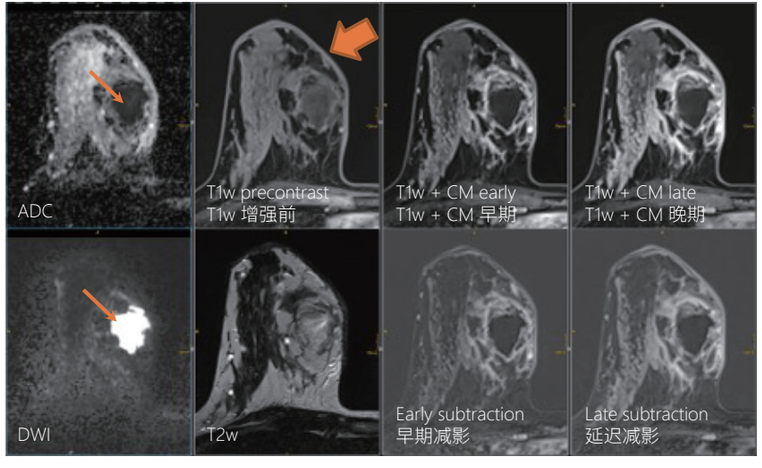
MRI 结果：

- T2W：水肿区域 T2 信号↑；
  - **局灶性 T2 高信号提示脓肿。**
- T1W C+：可见局灶性非肿块强化；
  - 肿块**边缘强化**提示脓肿或恶性肿瘤。

超声检查表现：

- 弥漫性或局部皮肤增厚，**水肿引起回声↑**，± 多普勒显示充血。
- ± 淋巴管扩张，导管内碎片、管壁增厚。
- 可能存在积液 ± 活动回声，液体-碎片平面，厚壁：**脓肿。**
- 常见反应性腋窝淋巴结，伴弥漫性皮质增厚。





A 29-year-old woman with 2-week history of right mastitis, presents with a medial, tender lump with associated warmth and erythema.

(**Upper**) Targeted US shows skin thickening, a hypoechoic collection surrounded by increased echogenicity due to edema. Vessels in rim on colour Doppler imaging.

(**Lower**) (same patient) MRI shows intermediate-intensity fluid collection and skin edema (**thick arrow**). Diffusion hindered abscess cavity has very high DWI signal and low ADC (**thin arrow**). T1W C+ shows rim enhancing mass and skin enhancement

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

29 岁女性，右侧乳腺炎病史 2 周，表现为内侧触痛性肿块，伴局部红、热。

（上）靶向 US 显示皮肤增厚，低回声区，水肿导致周围回声增强。彩色多普勒成像显示边缘血管。

（下）MRI 显示（同一患者），中等信号强度积液和皮肤水肿（**粗箭头**）。弥散受限：脓肿腔 DWI 呈极高信号，ADC 呈低信号（**细箭头**）。T1W C+ 显示，肿块边缘强化和皮肤强化

/ Hematoma

Hematoma is the localised collection of extravasated blood.

Etiology: Trauma, iatrogenic (biopsy, surgery), spontaneous (bleeding diathesis, anticoagulant therapy)

Signs and symptoms:

- / Painful, palpable, tender lump after known trauma or intervention; may occur spontaneously.
- / Overlying ecchymosis, skin discoloration.
- / Initially firm on palpation, may be fluctuant as hematoma evolves.

Most resolve rapidly and spontaneously **without intervention:**

- / Post-traumatic typically ⩽ 6 weeks, post-lumpectomy often ⩾ 1 year.
- / May evolve into fat necrosis with oil cyst formation.

<∞> REFERENCE

https://pmc.ncbi.nlm.nih.gov/articles/PMC4886616/

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 血肿

血肿是血液外渗形成的局部肿块。

病因：外伤，医源性（活检、手术），自发性（出血倾向、抗凝治疗）

体征和症状：

- / 已知外伤或干预后出现的疼痛、可触及、触痛性肿块；可自发出现。
- / 表面瘀斑，皮肤变色。
- / 最初触诊时坚实，随着血肿的发展可能出现波动感。

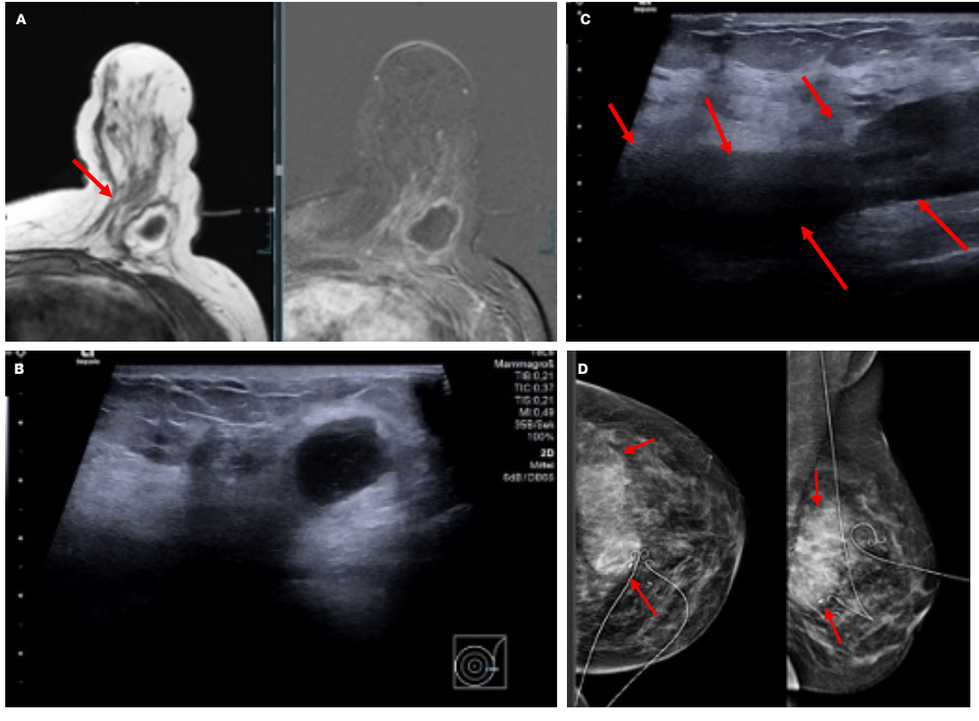
大多数**无需干预**即可迅速自行消退：

- / 创伤后通常 ⩽ 6 周，肿块切除术后通常 ⩾ 1 年。
- / 可发展为脂肪坏死伴油性囊肿形成。

<∞> 参考文献

https://pmc.ncbi.nlm.nih.gov/articles/PMC4886616/

/ Hematoma – Imaging



<!> ATTENTION

A 44-year-old woman with left breast suspicious lesion (not shown) presented for MR-guided biopsy. MR shows a 2-cm mass with low signal on T1, and with very thin peripheral enhancement on T1 C+ (**A**), consistent with acute hematoma during biopsy. Targeted US from same-day right after biopsy shows mildly irregular hypoechoic mass (**B**).

Control US (**C**) performed **2 weeks later** displays a 10-cm acute hematoma with internal echoes (**arrows**). Control MG (**D**), on the day of wire-marking shows a circumscribed mass lesion developed compatible with a hematoma. The position of the wires is highly debatable.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

/ 血肿 - 影像表现

<!> 注意

44 岁女性，左乳可疑病变（未显示），接受 MR 引导活检。MR 显示 2 cm 肿块，T1 呈低信号，T1 C+ 呈极薄外周强化 (**A**)，与活检急性血肿结论一致。活检后同天进行的靶向 US 显示，略不规则的低回声肿块 (**B**)。

2 周后对照 US(**C**) 显示，10 cm 急性血肿，伴有内部回声（箭头）。在导丝标记当天进行的对照 MG (**D**) 图像上，可见边缘清晰的肿块形成，符合血肿表现。导线位置存在较大争议。

/ Fat Necrosis

Fat necrosis within the breast is a pathological process that occurs when there is saponification of local fat. It is a benign inflammatory process and is becoming increasingly common with the greater use of breast-conserving surgery and mammoplasty procedures.

Etiology

- / No history of prior trauma or surgery in 35-50%.
- / Accidental injury (blunt or penetrating trauma).
- / Surgery/procedures (e.g. reduction mammoplasty).
- / Spontaneous development in patients with diabetes.
- / Chemical irritation (ruptured cyst or ectatic ducts).

<!> ATTENTION

Presentation

- / Highly variable.
- / May be asymptomatic on screening.
- / Tender or nontender, palpable mass or masses.
- / Firm, fixed mass, retraction.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 脂肪坏死

乳房内脂肪坏死是局部脂肪皂化时发生的病理过程，是一种良性的炎症反应。随着保乳手术和乳房成形术的广泛应用变得越来越常见。

病因

- / 35% -50% 的患者无既往外伤或手术史。
- / 意外损伤（钝性或穿透性创伤）。
- / 手术/诊疗操作（例如乳房缩小整形术）。
- / 糖尿病患者的自发性病程。
- / 化学刺激（囊肿破裂或导管扩张）。

<!> 注意

说明

- / 高度可变。
- / 筛查时可能无症状。
- / 伴或不伴触痛、可触及的肿块。
- / 坚实、固定肿块，回缩。

Fat Necrosis – Imaging

Mammographic Findings:

- **Round, oval, or lobulated lucent mass;**
  - Surrounding increased density due to edema, fibrosis, inflammatory infiltrate.
  - Develop peripheral rim calcifications over time.
- **Calcifications;**
  - Curvilinear, eggshell, at edge of oil cyst(s) or lobulated fatty mass.
  - Calc. due to fat necrosis can develop **many years after** trauma/surgery.
  - Coarse heterogeneous or curvilinear calc. most common; become coarser, dystrophic.
    - Fine linear or pleomorphic Ca^{++} less common.
- **Spiculated or irregular mass/asymmetry;**
  - Due to fibrosis/desmoplastic reaction.
- **Trabecular thickening due to edema should decrease over 3-6 months.**

Calcifications rarely seen < 1.5 years after trauma/surgery!!

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

脂肪坏死 - 影像表现

乳腺 X 线摄影：

- **圆形、椭圆形或分叶状的低密度肿块；**
  - 由于水肿、纤维化、炎性浸润，周围密度增加。
  - 逐渐出现外周边缘钙化。
- **钙化：**
  - 曲线状、蛋壳样，位于油性囊肿或分叶状脂肪肿块边缘。
  - 由脂肪坏死引起的钙化可在创伤/手术**多年后**发生。
  - 粗糙不均质钙化或曲线状钙化最常见；变得更粗糙、或转变为营养不良性钙化。
    - 细线或多形性钙化$^{++}$不常见。
- **毛刺状或不规则肿块/不对称；**
  - 由于纤维化/促纤维增生反应。
- **水肿引起的小梁增厚应在 3～6 个月内减轻。**

创伤/手术后 1.5 年内极少出现钙化！！

US Findings:

- Sonographic appearances **evolve** over time.
- **Acute phase:** Within days of event– Edema of breast fat → increased echogenicity.
- **Subacute:** ill-defined complex cystic areas within edematous fat.
- **Late phase: (≥ 18 months)** Wall calcifies: Intense posterior shadowing, spiculated mass with echogenic rim, distortion.
- Characteristically within **fat lobule** rather than between fat lobules.
- Colour or **power Doppler**: Internal flow may suggest **recurrent tumour** in lumpectomy patient.

Location : Most common in areas subareolar and superficial areas near skin

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

超声检查表现：

- 超声表现会随着时间的推移而**变化**。
- **急性期：**脂肪坏死发生几天内–乳房脂肪水肿→回声增强。
- **亚急性：**水肿的脂肪中出现边界不清的复杂囊性区域。
- **晚期：**（≥ 18 个月）囊壁钙化：后部强声影、伴强回声边缘的毛刺状肿块、结构扭曲。
- 通常位于**脂肪小叶**内，而非脂肪小叶之间。
- 彩色或**能量多普勒：**肿块切除患者出现内部血流可能提示**肿瘤复发**。

部位：最常见于乳晕下区和靠近皮肤的浅表区域

MR Findings:

- **T1WI:** High-signal central fat; suppresses more than normal fat on T1 FS.
- **T2WI:** Low signal ("black hole") with fat suppression, darker than normal fat.
- **DWI:** Unrestricted diffusion.
- **T1WI C+**
  - ~ 25% show no enhancement.
  - ~ 75% thin rim of peripheral enhancement – May persist up to 5 years post trauma/surgery.

Differential diagnosis:

- **Encapsulated Fat-Containing Lesions:** Lipoma, Fibroadenolipoma, Galactocele.
- **Ductal Carcinoma In Situ.**
  - Fine linear, pleomorphic Ca^{++}, can be similar to fat necrosis.
- **Invasive Ductal or Lobular Carcinoma.**
  - No history of trauma; irregular mass ± Ca^{++}.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

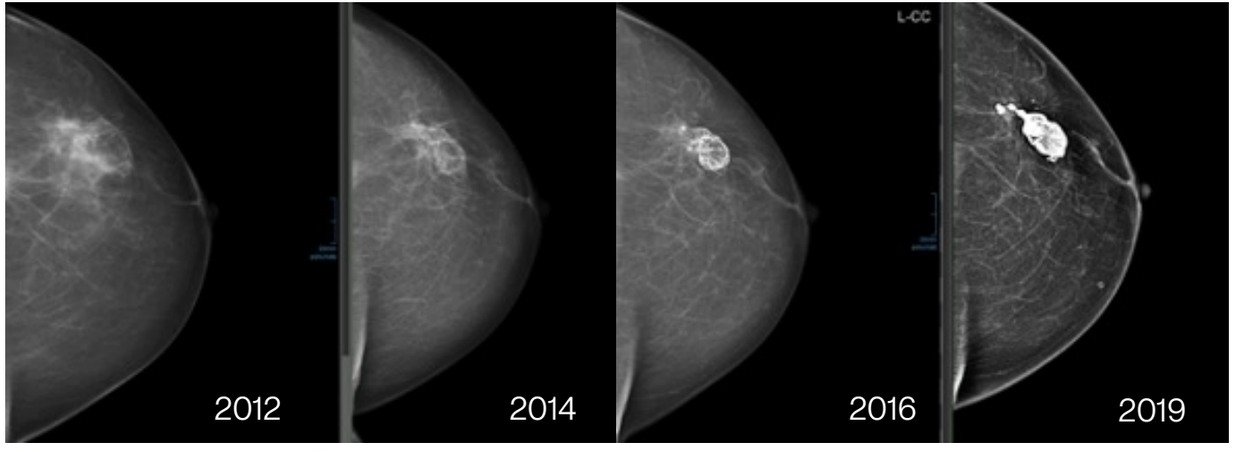
章节大纲：

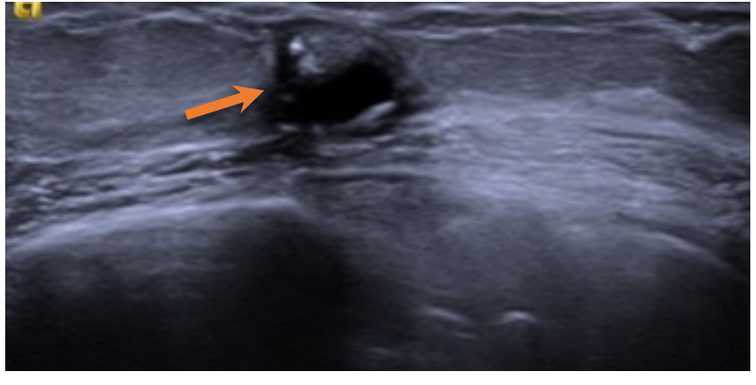
MR 结果：

- **T1WI：**中心脂肪呈高信号；在 T1 FS 上脂肪抑制程度超过正常脂肪。
- **T2WI：**脂肪抑制序列上呈低信号（“黑洞征”），信号低于正常脂肪
- **DWI：**无弥散受限。
- **T1WI C+**
  - 约 25% 显示无强化。
  - 约 75% 边缘呈薄环状强化 — 创伤/手术后可持续长达 5 年。

鉴别诊断：

- **含脂肪的良性病变：**脂肪瘤、纤维腺脂肪瘤和乳腺积乳囊肿。
- **导管原位癌。**
  - 细线、多形性钙化$^{++}$，可能类似于脂肪坏死。
- **浸润性导管癌或小叶癌。**
  - 无外伤史；不规则肿块 ± 钙化$^{++}$。





A 52-year-old woman in follow-up after left lumpectomy for DCIS. On CC (**upper**) mammograms, calcifying fat necrosis is seen at the lumpectomy scar over the years. Targeted US shows a centrally anechoic partially circumscribed mass with calcifications (**arrow**). The mass is within the subcutaneous fat.

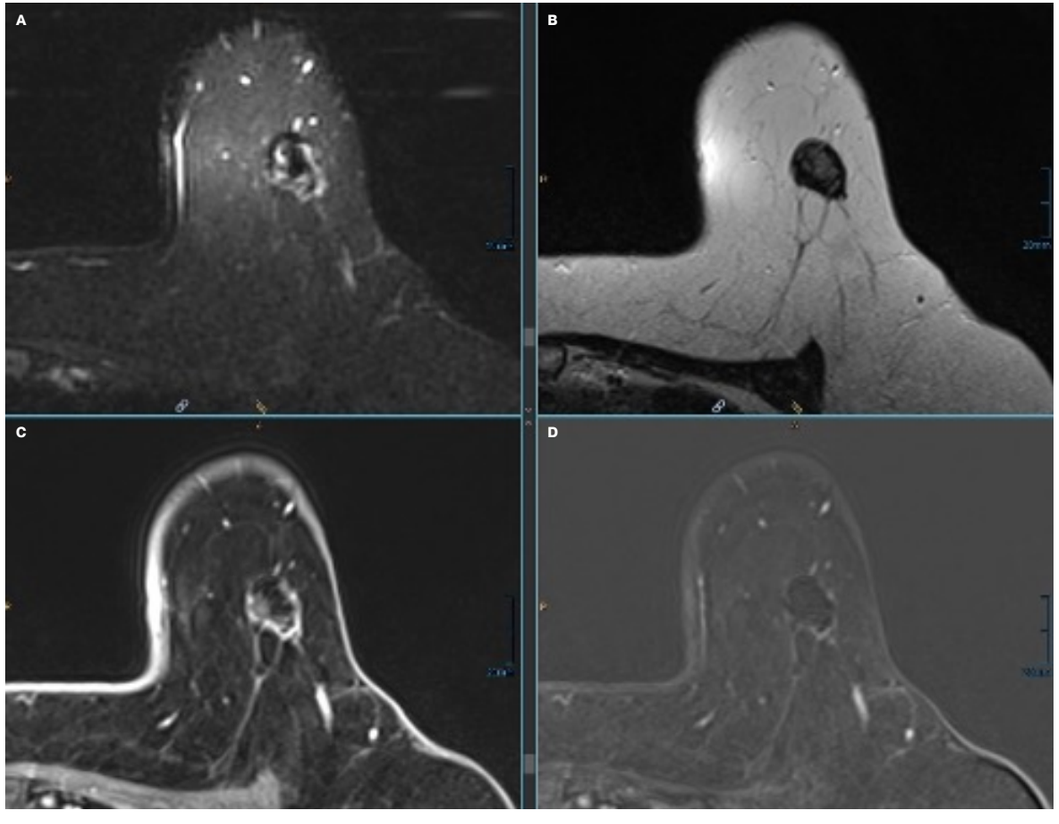
Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

52 岁女性，因 DCIS 接受左侧乳房肿瘤切除术后随访。在乳腺 X 线 CC 位图像上（上），术后多年的手术疤痕处可见钙化性脂肪坏死。靶向 US 显示，中央无回声，部分肿块边缘清晰，伴钙化（箭头）。肿块位于皮下脂肪内。



Axial STIR MR (**A**) (same patient) shows a peripherally T2-hyperintense, oval mass with central signal void due to fat necrosis having a shorter T1 time as normal fat (which is grey). Axial T2w without fat sat (**B**) shows a centrally mildly hyperintense mass with internal hypointense areas (likely calcifications). Axial T1 C+ FS and subtraction (**C-D**) MR shows minimal non-solid rim enhancement in this mass that is centrally hypointense and lacks central enhancement. Findings are consistent with fat necrosis.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

轴位 STIR MR(**A**) 显示（同一患者），肿块形态椭圆形，外周 T2 高信号，中央因脂肪坏死出现信号缺失；其 T1 时间短于正常脂肪（正常脂肪在该序列上呈灰色）。无脂肪抑制的轴位 T2w(**B**) 显示，肿块中心轻度高信号，伴内部低信号区（可能是钙化）。轴位 T1 C+FS 和减影（**C-D**）MR 显示，该肿块中心呈低信号且无中心强化，仅见轻微的非实性边缘强化。结果符合脂肪坏死特征。

Disease of the Breast: Malignant

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

乳腺疾病：恶性

/ Indications, Advantages and Disadvantages of Diagnostic Techniques in Malignant Breast Lesions

Mammography (diagnostic imaging, bilateral 2 views and additional views)

- / High specificity
- / Low sensitivity in dense breasts
- / High sensitivity for microcalcifications
- / Guided biopsy for mammographically detected lesions (most frequent microcalcifications)

Ultrasound (US) of bilateral breast and axilla

- / Differentiation between mass and cystic lesion
- / Low specificity
- / Biopsy guided technique for the assessment of breast lesions

Magnetic resonance imaging (MRI)

- / High sensitivity and specificity
- / Biopsy guided technique for the exploration of MRI detected lesions

<!> ATTENTION

Mammography and US are mandatory in the investigation of all suspicious breast lesions. Additional MRI is strongly advised in case of invasive lobular carcinoma, dense breast, positive family history, gene mutation carrier and suspiciousness of multicentric or bilateral breast cancer.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 诊断技术对于乳腺恶性病变的适应证与优缺点

乳腺 X 线摄影（诊断成像、双侧 2 种体位和额外体位）

- / 特异性高
- / 对致密型乳腺敏感性低
- / 对微钙化具有高度的敏感性
- / 可对乳腺 X 线摄影检出的病变（微钙化最常见）进行引导活检

双侧乳房与腋窝超声 (US)

- / 肿块与囊性病变的鉴别
- / 特异性低
- / 活检引导技术，用于评估乳腺病变

磁共振成像 (MRI)

- / 高灵敏度与特异性
- / 活检引导技术，用于探查 MRI 检出的病变

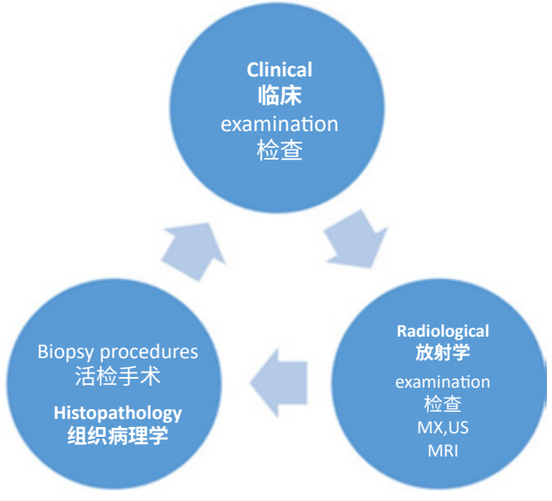
<!> 注意

乳腺 X 线摄影和超声检查是评估所有可疑乳腺病变时必须的。对于浸润性小叶癌、致密型乳腺、阳性家族史、基因突变携带者以及疑似多中心或双侧乳腺癌的病例，强烈建议进行额外的 MRI 检查。

A **triple assessment** is mandatory for the investigation of suspicious breast lesions. It consists of a clinical examination by a trained professional, a radiological investigation and a biopsy procedure.

<!> ATTENTION

Final correlation between pathology results, clinical and imaging findings is mandatory. If a discrepancy occur, additional imaging is necessary!



A mammography (MX), ultrasound and MRI report contains a full description of both breasts, a final assessment, impression and recommendation.

A uniform description and assessment helps the radiologist to communicate about the imaging results. One of the most frequently used protocol is the Breast Imaging Reporting and Database System (BI-RADS).

In this chapter, the BI-RADS descriptors will be used to explain the presentations of malignant lesions in the breast on MX, US and MRI.

<∞> REFERENCE

https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Reporting-and-Data-Systems/BI-RADS

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

对可疑乳腺病变的检查，必须进行三联评估，具体包括由经过相关培训的专业人员进行的临床检查、影像检查和活检程序。

<!> 注意

病理结果、临床和影像检查结果之间必须存在最终相关性。若出现不一致，则须进行额外的影像检查！

乳腺 X 线摄影 (MX)、超声和 MRI 报告包含对双侧乳房的完整描述、最终评估、印象诊断和建议。

统一的描述和评估有助于放射科医师就影像检查结果进行沟通。最常用的标准之一便是乳腺影像报告和数据系统 (BI-RADS)。

在本章中，BI-RADS 描述语将用于解释乳腺恶性病变在 MX、US 和 MRI 上的表现。

<∞> 参考文献

https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Reporting-and-Data-Systems/BI-RADS

A breast imaging report contains

- Clinical information and indication.
- Comparison with priors (date and type of exam).
- Breast density - Tissue composition- enhancement pattern.
- Skin, nipple and areola.
- Lesions;
  - Mass, Asymmetry, Architectural distorsion.
  - Calcifications.
- Location, size of each lesion, distance to the nipple.
- Secondary signs (skin, nipple).
- Lymph node status.
- Assessment category.
- Recommendations.

<∞> REFERENCE

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

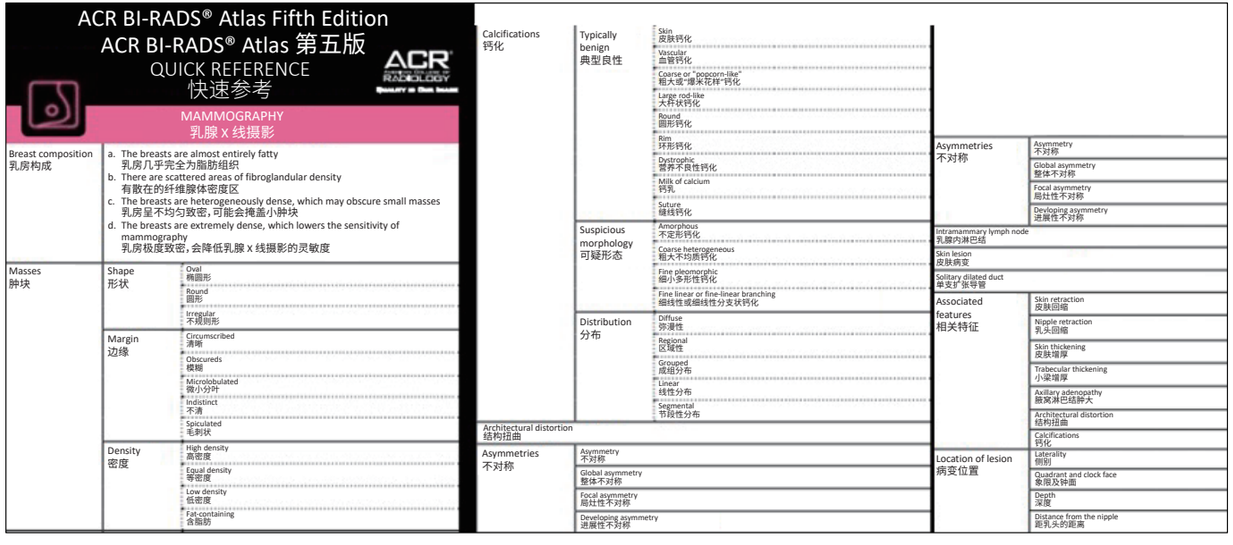
乳腺影像报告包含：

- 临床信息和适应证。
- 与既往检查的比较（检查日期和类型）。
- 乳腺密度 - 组织构成 - 增强模式。
- 皮肤、乳头和乳晕。
- 病变；
  - 肿块、不对称和结构扭曲。
  - 钙化。
- 位置、病变大小和距乳头的距离。
- 次要体征（皮肤、乳头）。
- 淋巴结状态。
- 评估分类。
- 建议。

<∞> 参考文献

On **mammography** malignant lesions can present as a

- Mass
- Asymmetry
- Architectural distortion
- Microcalcifications



<∞> REFERENCE

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

在乳腺 X 线摄影中，恶性病变可表现为

- 肿块
- 结构扭曲
- 不对称
- 微钙化

章节大纲：

<∞> 参考文献

On **mammography** a malignant mass has an irregular shape with microlobulated, indistinct or spiculated margins. The density is higher than the surrounding tissue. Associated signs of malignancy are suspicious microcalcifications. Associated findings can be skin and nipple retraction and thickening.

Mammography

Mass:

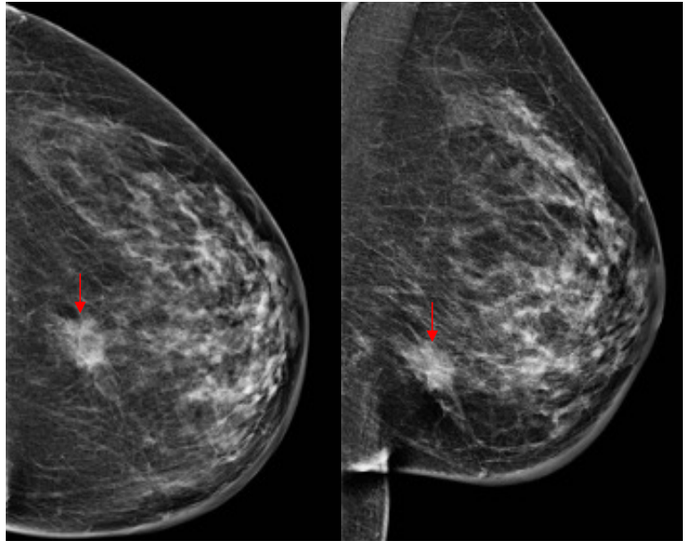
Shape: oval (may include 2 or 3 lobulations), round, **irregular**

Margins: circumscribed, **obscured, microlobulated, indistinct, spiculated**

Density: high, equal, low or fat-containing

Associated microcalcifications
Associated findings: skin thickening

Location (left/right, quadrant, clock-wise, periareolar, middle, posterior)



Mass lesion (**arrow**) with an irregular shape, spiculated margins and high density. Skin thickening of the inner and lower part of the breast. Pathology showed an invasive ductal carcinoma 25 mm in size.

<∞> REFERENCE

www.ACR.org

/ Breast Imaging

/ 乳腺影像学

在乳腺 X 线摄影中，恶性肿块形状不规则，边缘不清、微分叶状或毛刺状。密度高于周围组织。恶性肿瘤的相关征象之一便是可疑微钙化。相关表现可为皮肤及乳头回缩和增厚。

乳腺 X 线摄影

肿块：

形状：椭圆形（可能包括 2 或 3 个分叶）、圆形、**不规则形**

边缘：边缘清晰、**不清晰、微分叶状、模糊、毛刺状**

密度：高、等、低或含脂肪

相关微钙化相关表现：皮肤增厚

位置（左/右、象限、顺时针、乳晕周围、中间、后部）

<∞> 参考文献

www.ACR.org

肿块病变（箭头），形状不规则，边缘呈毛刺状，密度高。乳房内下部皮肤增厚。病理示浸润性导管癌，大小 25 mm。

- **Microcalcifications** can be associated with a malignant mass, or asymmetry or architectural distortion, but can also be present as the only finding in ductal carcinoma in situ.
- The amount, type and distribution of microcalcifications should be analysed: fine linear or branching microcalcifiations in a linear and segmental distributions are very suspicious for ductal carcinoma in situ (DCIS).

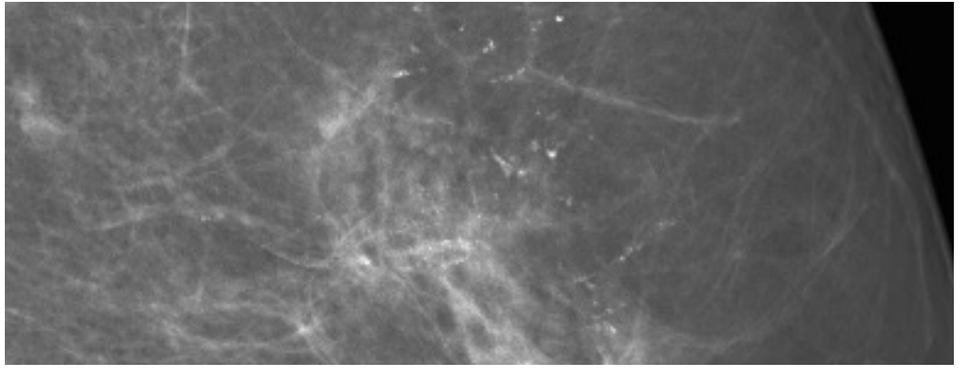
Mammography

Microcalcifications:

Morphology: fine-linear branching

Distribution: linear and segmental

Change over time: stability over time of suspicious calcifications is unreliable



<∞> REFERENCE

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

- 微钙化可能与恶性肿块、不对称或结构扭曲相关，但也是导管原位癌的唯一表现。
- 应分析微钙化的数量、类型和分布：线样和段样分布的细线样或分支状微钙化，高度怀疑导管原位癌 (DCIS)。

乳腺 X 线摄影

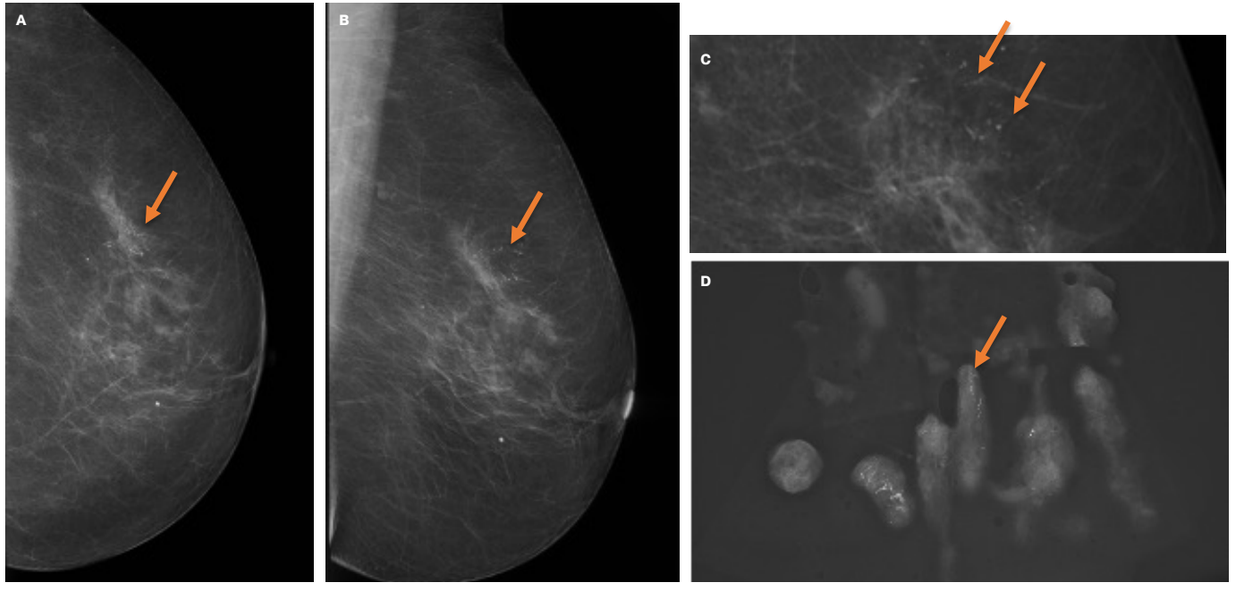
微钙化：

形态：细线分支状

分布：线样和段样

随时间变化：可疑钙化随时间的稳定性会变化，不可靠

<∞> 参考文献



(**A and B**) CC and MLO view of the left breast show a segmental distribution of microcalcifications in the upper outer quadrant, pathology: ductal carcinoma in situ (DCIS)

(**C**) Magnification view in MLO shows fine linear branching calcifications, organised in a ductal pattern, in a segmental distribution

(**D**) Specimen (magnification) image shows the irregular branching or casting calcifications

<∞> REFERENCE

www.ACR.org

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

（**A、B**）左侧乳腺 CC、MLO 位显示，外上象限存在段样分布的微钙化；病理示：导管原位癌 (DCIS)

(**C**) MLO 放大视图显示，段样分布的细线分支状钙化，呈导管模式

(**D**) 标本（放大）图像显示，不规则分支状或铸型钙化

<∞> 参考文献

www.ACR.org

Mammography

Architectural distortion:

Thin straight lines or spiculations radiating from a central area, and focal retraction, distortion or straightening at the edges of the parenchyma

MLO tomo view of the right breast shows a small distortion in the upper quadrants (arrow); pathology revealed an invasive ductal carcinoma of 1.8cm.

<!> ATTENTION

<∞> REFERENCE

www.ACR.org

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

乳腺 X 线摄影

结构扭曲：

从中心区域发出的放射状细直线或毛刺以及局灶性收缩，或实质的边缘扭曲或变直

右乳 MLO 断层视图显示，上象限有小结构扭曲（箭头）；病理学示浸润性导管癌，直径 1.8 cm。

<!> 注意

<∞> 参考文献

www.ACR.org

<!> ATTENTION

Mammography

Asymmetry: area of fibroglandular tissue visible on only one mammographic projection (superimposition of normal breast tissue).

- **Focal asymmetry** visible on two projections, hence a real finding rather than superimposition.
- **Global asymmetry** consisting of an asymmetry over at least one quarter of the breast and is usually a normal variant.
- **Developing asymmetry** new, larger and more conspicuous than on a previous examination. A developing asymmetry is suspicious and needs always further investigation with US and in case of discordant results, MRI.

<∞> REFERENCE

www.ACR.org

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

<!> 注意

乳腺 X 线摄影

不对称：仅在一个乳腺X线投照体位上可见纤维腺体组织区（正常乳腺组织的叠加）。

- **局灶不对称**指两个体位上均可见，因此这是真实发现而非腺体叠加。
- **整体不对称**指乳房至少四分之一不对称，通常是一种正常变异。
- **进展性不对称**指出现新的不对称，以及原不对称比既往检查更大、更明显。进展性不对称是可疑的，需进一步超声检查。若结果不一致，则需进行 MRI 检查。

<∞> 参考文献

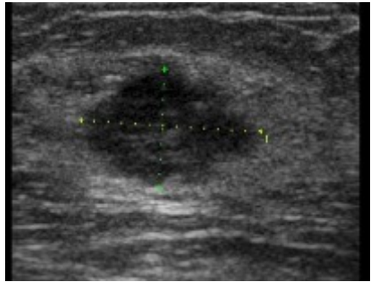
www.ACR.org

Ultrasound

On **ultrasound** a malignant lesions is heterogeneous, hypoechoic (darker) with an irregular shape, and angular, microlobulated or spiculated margins.

The orientation is not parallel to the skin and posterior lesion shadowing is often present.

Ultrasound Lexicon 超声术语词典		
Breast composition **乳房构成**	a. homogeneous - fat 均质 - 脂肪 b. homogeneous - fibroglandular 均质-纤维腺体 c. heterogeneous 不均质	
Mass **肿块**	**shape** **形状**	oval - round - irregular 椭圆形 - 圆形 - 不规则形
	margin **边缘**	Circumscribed **or** Not-circumscribed: 清晰**或**不清晰： indistinct, angular, microlobulated, spiculated 包括不清、成角、微小分叶、毛刺状
	orientation **方位**	parallel - not parallel 平行 - 不平行
	echo pattern **回声模式**	anechoic - hyperechoic - complex cystic/solid hypoechoic - isoechoic - heterogeneous 无回声 - 高回声 - 复杂囊实混合回声 低回声 - 等回声 - 不均质回声
	posterior features **后方特征**	no features - enhancement - shadowing - combined pattern 无特殊表现 - 回声增强 - 声影 - 混合模式
Calcifications **钙化**	in mass - outside mass - intraductal 肿块内 - 肿块外 - 导管内	
Associated features **相关特征**	architectural distortion - duct changes - skin thickening - skin retraction - edema - vascularity (absent, internal, rim) - elasticity 结构扭曲 - 导管改变 - 皮肤增厚 - 皮肤回缩 - 水肿 - 血流（无、内部、边缘）- 弹性	
Special cases (cases with a unique diagnosis) **特殊情况（具有独特诊断的情况）**	simple cyst - clustered microcysts - complicated cyst - mass in or on skin - foreign body (including implants)-intramammary lymph node - AVM - Mondor disease - postsurgical fluid collection - fat necrosis 单纯囊肿 - 簇状微囊肿 - 复杂囊肿 - 皮肤肿物 - 异物（包括植入物）- 乳房内淋巴结 - AVM - Mondor 病 - 术后积液 - 脂肪坏死	



Ultrasound image of the mass lesion seen on MX in fig 1 shows an hypoechoic mass with an irregluar shape, and microlobulated, angular margins.

Ultrasound image of the mass lesion on MX in fig 2 shows an hypoechoic mass with irregluar shape, indistinct margins, with retroacoustic shadow. The reflections in the mass represent the pathological microcalcifications

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

超声检查

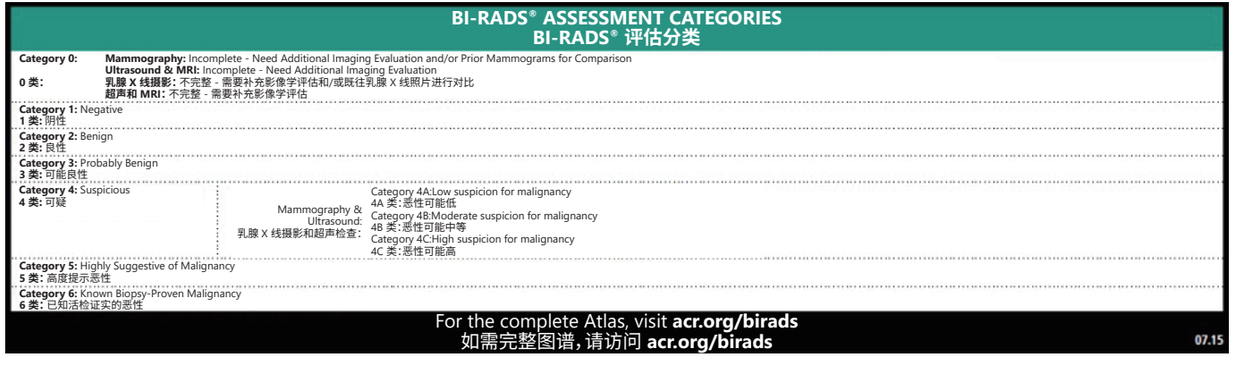
超声显示，恶性病变表现为形状不规则、不均匀低回声（更黑），边缘成角、微分叶状或毛刺状。

其方向与皮肤不平行，常出现病变后方声影。

图 1 中 MX 上所见肿块病变的超声图像显示，低回声肿块，形状不规则，边缘不清晰、成角。

图 2 中 MX 上肿块病变的超声图像显示，低回声肿块，形状不规则，边缘不清晰，伴后方声影。肿块内的反射代表病理性微钙化

- If the characteristics of the lesion indicate a malignancy, BI-RADS category is 4 (4A, 4B, 4C), 5 or 6 is the final assessment.
- Based on this classification an additional minimal invasive diagnostic technique such as a core needle biopsy must be performed (triple assessment).



<∞> REFERENCE

www.ACR.org/birads

Breast Imaging

乳腺影像学

CHAPTER OUTLINE:

章节大纲:

- 如果病变特征提示恶性肿瘤，则 BI-RADS 类别为 4（4A、4B、4C），5 或 6 为最终评估。
- 基于该分类，必须实施其他微创诊断技术（三联评估），如空芯针活检。

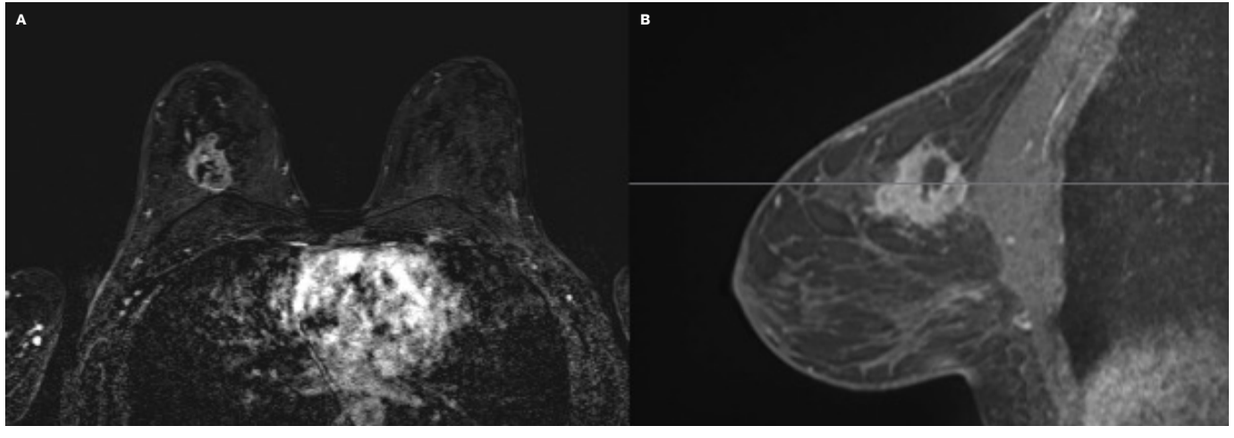
<∞> 参考文献

www.ACR.org/birads

MRI

On **MRI** a malignant lesion shows a heterogeneous and rim enhancement.

The shape is irregular and margins are spiculated. Besides the morphology, the lesion shows a rapid increase in signal after the injection of contrast followed by a washout in the delayed phase.



Contrast-enhanced MRI, subtraction image axial plane (**A**) and T1Wwith fat suppression saggital plane (B) of the tumour shows a lesion with heterogeneous and rim enhancement, the shape and margins are irregular. The pattern of enhacement is highly suspicious of malignancy.

<∞> REFERENCE
www.ACR.org/-/media

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

MRI

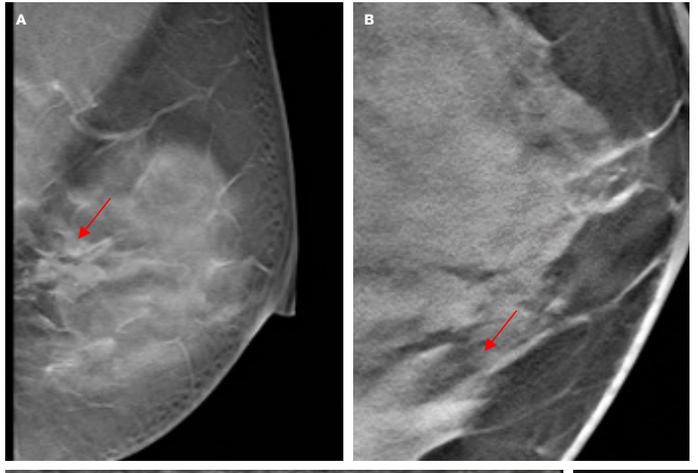
在 **MRI** 上，恶性病变显示不均匀、环形强化。

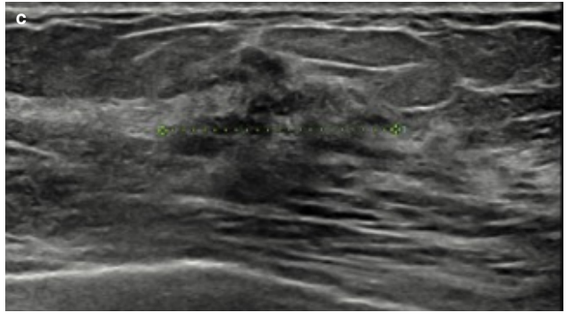
形状不规则，边缘呈毛刺状。除形态外，病变在注射对比剂后信号迅速增加，随后在延迟期流出。

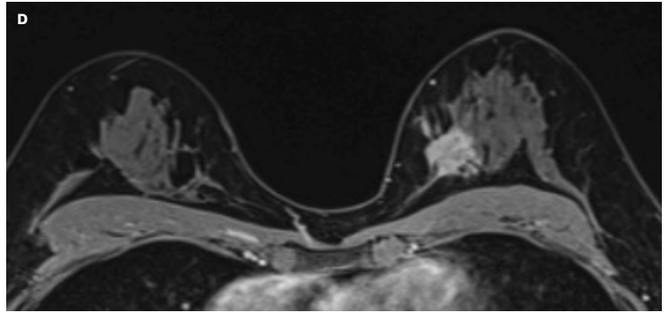
对比增强 MRI、轴位减影图像 (**A**) 和矢状位压脂 T1W (B) 显示，病变不均匀、环形强化，形状和边缘不规则。这种增强模式高度怀疑是恶性肿瘤。

<∞> 参考文献
www.ACR.org/-/media

Multimodality assessment of a malignant breast lesion







High density mass (**A and B**) lesion with spiculated margins and irregular shape, medial at 9 o' clock in the left breast on the digital breast tomosynthesis slices (arrow)s.

Ultrasound (**C**) shows an irregular lesion (between callipers), inhomogeneous, microlobulated.

On MRI (**D**) a strong enhancing, irregular, spiculated lesion with inhomogeneous enhancement.

Histology revealed an invasive ductal carcinoma of 2.3cm.

Breast Imaging

乳腺影像学

乳腺恶性病变的多模式评估

CHAPTER OUTLINE:

章节大纲：

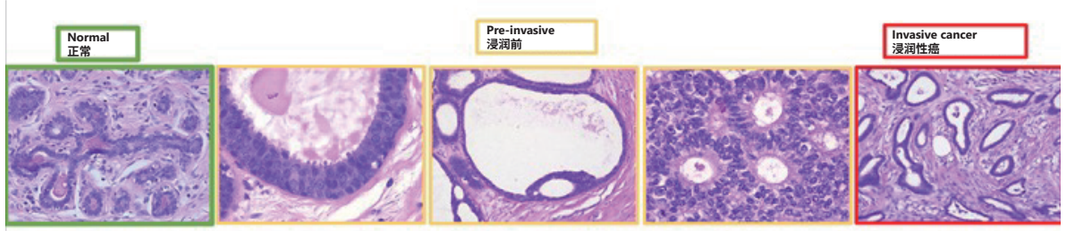
在数字乳腺断层合成摄影图像上，左乳内 9 点钟方向出现高密度肿块（**A 和 B**），形状不规则，边缘呈毛刺状（箭头）。

超声 (**C**) 显示不规则病变（测量点之间），不均匀，呈微分叶。

MRI(**D**) 上表现为不规则、毛刺状病变，不均匀显著强化。

组织学示浸润性导管癌，直径 2.3 cm。

Histology of in Situ & Invasive Breast Cancer



Courtesy: G. Floris, MD, University Hospitals Leuven, Belgium

- Within the normal mammary and **terminal ductal mammary lobar unit (TDLU)**, a layer of epithelial cells and a layer of myoepithelial cells are surrounded by a basement membrane.
- **In DCIS,** the epithelial cells are phenotypically different from normal epithelial cells (poorly differentiated DCIS more than well-differentiated DCIS). However, they are **still surrounded by a basement membrane**.
- DCIS encompasses a group of histologically and prognostically **heterogeneous non-invasive carcinomas**. **Microcalcifications** are the main imaging finding in DCIS.
- Once the neoplastic cells invade the basement membrane into the breast stroma, they have transitioned to an **invasive ductal carcinoma**.

<∞> REFERENCE

Breast Cancer Biology for the Radiation Oncologist, 2015; ISBN : 978-3-642-31219-9
Chapter: Biology of DCIS and progression to invasive disease.Sanaz A. Jansen
Diagnostic breast imaging, SH Heywant-Köbrinnner, D Dersaw, I Schreer, Thieme

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

组织学：原位癌和浸润性乳腺癌

来源：由比利时鲁汶大学医院医学博士 G. Floris 提供

- 在正常乳腺和**终末导管小叶单位 (TDLU)** 中，一层上皮细胞和一层肌上皮细胞均被基底膜包裹。
- **在 DCIS 中，**上皮细胞的表型不同于正常上皮细胞（低分化 DCIS 多于高分化 DCIS），但**仍被基底膜包裹。**
- DCIS 包括一组组织学类型、预后**不同的非浸润性癌。微钙化**是 DCIS 的主要影像表现。
- 一旦肿瘤细胞侵入基底膜进入乳腺基质，便转变为**浸润性导管癌。**

<∞> 参考文献

Breast Cancer Biology for the Radiation Oncologist, 2015; ISBN : 978-3-642-31219-9
Chapter: Biology of DCIS and progression to invasive disease.Sanaz A. Jansen
Diagnostic breast imaging, SH Heywant-Köbrinnner, D Dersaw, I Schreer, Thieme

- The most frequent type of carcinoma is **invasive ductal carcinoma** (IDC) Not Otherwise Specified (NOS) type (80%), followed by the invasive lobular carcinoma (about 15%) .
- Special types of invasive ductal carcinomas are:
  - Mucinous carcinoma (3%)
  - Tubular carcinoma (2-3%)
  - Medullar carcinoma (3-4%)
  - Papillary carcinoma (2%).
- Mucinous carcinoma and medullary carcinoma are sometimes well circumscribed.
- Therefore, to differentiate from a fibroadenoma, core needle biopsy is indicated in case a new of growing lesion is detected.
- Inflammatory breast cancer is a condition in which tumour cells are in the lymphatic skin vessels, responsible for the clinical presentation of oedema, erythema and hyperthermia.
- Other rarer types of carcinoma include Paget' s disease of the nipple, malignant phyllodes tumour and sarcoma 'of the breast.

Skin oedema, redness of the right breast, courtesy of Multidisciplinary Breast Center, University Hospitals Leuven, Belgium

<∞> REFERENCE

Diagnostic breast imaging, SH Heywant-Köbrinner, D Dersaw, I Schreer, Thieme

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

- 最常见癌症类型为浸润性导管癌 (IDC) 非特殊 (NOS) 类型 (80%)，其次是浸润性小叶癌（约 15%）。
- 浸润性导管癌特殊类型包括：
  - 黏液癌 (3%)
  - 小管癌 (2-3%)
  - 髓样癌 (3-4%)
  - 乳头状癌 (2%)。
- 黏液癌和髓样癌有时也会表现为边缘清晰。
- 因此，为了与纤维腺瘤区分，若检出新的正在生长的病变，则需进行空芯针活检。
- 炎性乳腺癌是一种肿瘤细胞位于淋巴皮肤血管内的疾病，其临床表现为水肿、红斑和高热。
- 其他较罕见的癌症类型包括乳头佩吉特病、恶性叶状肿瘤和乳腺肉瘤。

右乳皮肤水肿、发红，由比利时鲁汶大学医院多学科乳腺中心提供

<∞> 参考文献

Diagnostic breast imaging, SH Heywant-Köbrinnner, D Dersaw, I Schreer, Thieme

Axilla

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

腋窝

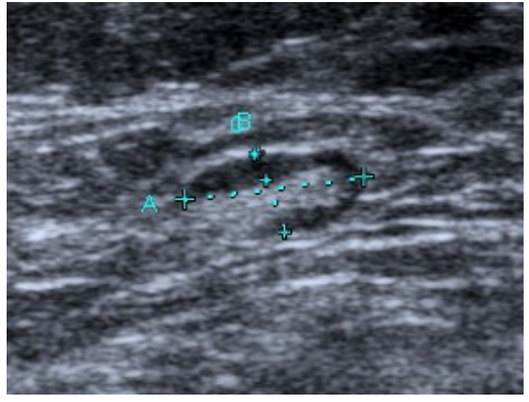
/ Background

<!> ATTENTION

The presence of axillary node metastasis remains one of most important prognostic factors in breast cancer.

Approximately 30-40% of newly diagnosed breast cancer patients will have nodal metastases.

It is routine practice to perform axillary ultrasound in all patients with suspected breast cancer on initial imaging.



Ultrasound appearances of a normal axillary lymph node

Axillary ultrasound being performed in a patient with suspected breast cancer. Note the abducted position of the arm

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 背景

<!> 注意

腋窝淋巴结转移仍然是乳腺癌最重要的预后因素之一。

大约 30%-40% 的新确诊乳腺癌患者均会发生淋巴结转移。

在临床实践中，常规做法是对所有初诊影像学检查提示乳腺癌可能的患者进行腋窝超声检查。

正常腋窝淋巴结超声表现

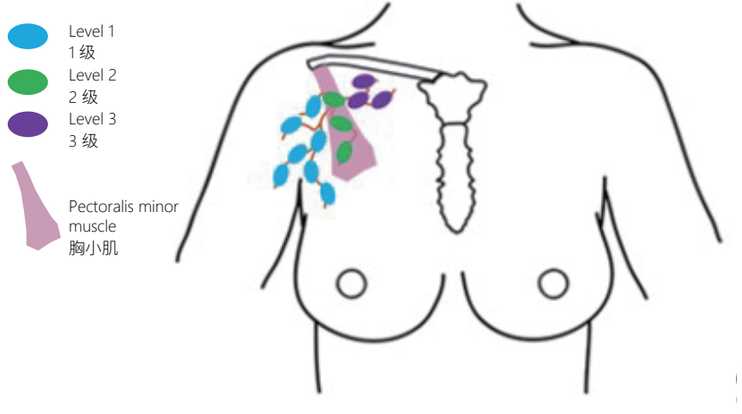
对怀疑乳腺癌患者行腋窝超声检查。注意手臂外展位

/ Anatomy of the Axilla

/ Anatomically the axilla has a 3 dimensional shape resembling a pyramid, and contains structures including the axillary artery and vein, brachial plexus, and axillary lymph nodes.

/ The axilla is divided into three levels by the pectoralis minor muscle.

/ Drainage generally proceeds in a stepwise fashion from level I to II to III, and finally into the thorax.



Anatomy of axillary lymph node levels depending on location of the pectoralis minor muscle

<!> ATTENTION

Nodal metastases to level III carry a worse prognosis than metastases to level I and level II axillary nodes.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 腋窝的解剖结构

/ 从解剖学角度来看，腋窝呈近似锥体的 3D 形状，其中包含腋动静脉、臂丛神经和腋窝淋巴结等结构。

/ 腋窝可按照胸小肌分成 3 个层次。

/ 引流通常遵循从 I 区至 II 区再到 III 区淋巴结的顺序逐步进行，最终引流至胸部。

基于胸小肌位置划分的腋窝淋巴结分区解剖图

<!> 注意

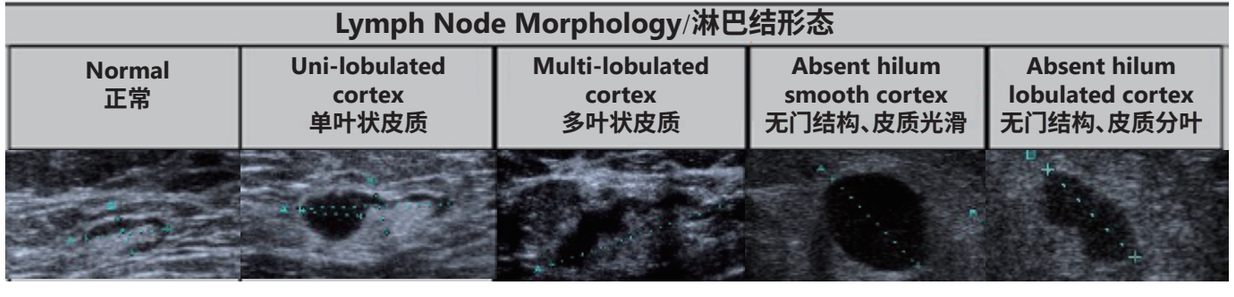
相较于 I 区和 II 区腋窝淋巴结转移，III 区淋巴结转移患者预后更差。

/ Appearances of Axillary Lymph Nodes on Ultrasound

The normal axillary lymph node should be oval with a smooth, well-defined margin and a uniformly thin hypoechoic cortex. The echogenic hilum should comprise most of the lymph node.

Cortical thickening or a focal cortical budge are considered the earliest detectable changes.

Replacement of the entire node by an ill-defined mass is highly suspicious for malignant involvement of nodes, however this finding is non-specific and is often associated with reactive nodes.



Appearances of normal and abnormal axillary lymph nodes on US .

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 腋窝淋巴结超声表现

正常的腋窝淋巴结应呈椭圆形形态，边缘光滑、边界清晰，且均匀薄层的低回声皮质。强回声淋巴门应占据淋巴结的大部分体积。

最早期的病理性改变表现为皮质增厚或局灶性皮质隆起。

边界不清的肿块完全取代淋巴结结构虽高度提示恶性浸润可能，但需注意该表现非特异性，亦常见于淋巴结反应性增生。

正常和异常腋窝淋巴结的超声表现。

/ Intervention in the Axilla

<!> ATTENTION

If ultrasound evaluation of the axilla reveals a suspicious finding, percutaneous procedures including ultrasound guided fine needle aspiration (FNA) or ultrasound guided core needle biopsy (CNB) should be performed to substantiate clinical decision making.

Biopsy needle through a lymph node cortex.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 腋窝部位的介入

<!> 注意

如果腋窝超声评估结果可疑，应行超声引导下细针穿刺抽吸活检 (FNA) 或超声引导下空芯针活检 (CNB) 等经皮操作，以指导临床决策。

用活检针穿刺淋巴结皮质。

Interventional Procedures

Breast Imaging

CHAPTER OUTLINE:

介入治疗

乳腺影像学

章节大纲：

/ Interventional Procedures

/ **Percutaneous image-guided needle biopsy** is part of the so called “diagnostic triad” in breast imaging together with mammography and ultrasound. It is essential in the management of suspicious breast lesions detected by screening or during assessment of clinical abnormalities. It is safe and cost effective, allowing accurate decision making, including treatment planning.

/ The most appropriate image guide is chosen by radiologist (whenever a lesion is seen on ultrasound, this technique is preferred!).

/ Different percutaneous image-guided techniques are available:

1. **Fine-Needle Aspiration Cytology (FNAC)** > providing material to study cells
2. **Core Needle Biopsy (CNB)**
3. **Vacuum-Assisted Biopsy (VAB)** > providing material to study tissue

/ Indications:

- / BI-RADS Category 4A: >2% but ⩽10% likelihood of malignancy
- / BI-RADS Category 4B: >10% but ⩽50% likelihood of malignancy
- / BI-RADS Category 4C: >50% but <95% likelihood of malignancy
- / BI-RADS Category 5 : >95% likelihood of malignancy

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 介入治疗

/ **经皮影像引导穿刺活检**与乳腺 X 线摄影和超声共同组成乳腺成像的“诊断三件套”。该检查手段对筛查或临床评估发现的可疑乳腺病变的管理具有关键指导价值。其兼具安全性和经济性，有助于临床决策和治疗方案制定。

/ 放射科医生会相应地选择最合适的影像引导方式（超声可见病变首选此方法）。

/ 目前主要的经皮影像引导技术包括：

1. **细针抽吸细胞学检查 (FNAC)** > 提供用于检测的细胞标本
2. **空芯针活检 (CNB)**
3. **真空辅助活检 (VAB)** > 提供用于检测的组织标本

/ 适应证：

- / BI-RADS 4A 类：恶性概率 >2% 但 ⩽10%
- / BI-RADS 4B 类：恶性概率 >10% 但 ⩽50%
- / BI-RADS 4C 类：恶性概率 >50% 但 <95%
- / BI-RADS 5 类：恶性概率 >95%

/ Fine Needle Aspiration Cytology

Fine Needle Aspiration Cytology (FNAC) provides material for studying cells allowing a cytological examination

/ **Principle:** usually performed under US guidance with a **27-18 gauge** fine needle that is inserted very close to US probe. Once the needle is in the target, manual multidirectional sampling is performed, through aspiration using 10-20 ml syringe or simple by manual movement of the needle inside for about 10-20 sec. The extracted material is spread onto slides and fixed in formalin for analysis.

Indications:

/ Drainage of complicated cysts, seromas, hematomas.

/ For therapeutic purposes:

  / pain relief from swelling cysts, therapy of lactational and non lactational breast abscesses.

/ Currently discouraged for diagnostic purposes for the lack of molecular information and inadequate rate.

ADVANTAGES:

+ Easy, safe and fast procedure.
+ Cost and availability.

DISADVANTAGES:

− No histopathological analysis.
− High rates of inadequate or false negative results.

>-< FURTHER KNOWLEDGE

False negative rate ranges up to 20%.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 细针抽吸细胞学检查

细针抽吸细胞学检查 (FNAC) 提供用于检测的细胞标本，以便进行细胞学检查

/ **操作方式：**通常在超声 US 引导下使用 **27-18** 号细针（插入位置非常靠近 US 探头）进行。针头到达目标部位后，手动进行多向取样，使用 10-20 mL 注射器抽吸，或手动将针头在内部移动约 10-20 s。将提取的物质涂布到载玻片上，并用福尔马林固定以备分析。

适应证：

/ 复杂囊肿、浆液肿、血肿的引流。

/ 对于以下治疗目的：

  / 缓解囊肿肿胀引起的疼痛，治疗哺乳期和非哺乳期乳房脓肿。

/ 由于分子信息不足和比率不充分，目前不推荐用于诊断。

优点：

+ 操作简单、安全、快速。
+ 低成本和高可用性。

缺点：

− 无组织病理学分析。
− 结果不充分或假阴性率高。

>-< 进阶知识

假阴性率范围高达 20%。

/ Core Needle Biopsy

Core Needle Biopsy (CNB) provides material for histopathological analysis.

/ **Principle:** usually performed under US guidance with a needle from 16 to 12 gauge (recommended 14 gauge). Using an aseptic technique and after local anaesthesia administered through subcutaneous injections (lidocaine/mepivacaine) the needle is inserted, through a small skin incision. Once the needle is in the target a number of cores (3-5) are obtained to document the correct needle positioning. The extracted material is placed in formalin. Post interventional marker clip must be deployed in patients undergoing neoadjuvant treatment or upon radiologist indication.

Indications:

/ Suspicious (BI-RADS 4a,4b,4c-5) lesions seen at US.

/ Axillary lymph nodes assessment.

ADVANTAGES:

+ Easy, safe and fast procedure.
+ Cost and availability.

DISADVANTAGES:

− Subsequent samples imply needle extractions.
− False negative rate 1.2-3.3%.

>-< FURTHER KNOWLEDGE

False negative rate ranges from 1.2 to 3.3% (mean 2%).

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 空芯针活检

空芯针活检 (CNB) 可以为组织病理学分析提供材料。

/ **操作方式：**通常在 US 引导下使用 16 至 12 号针头（推荐 14 号）进行。采用无菌技术，在局部皮下麻醉（利多卡因/甲哌卡因）后，经皮微小切口置入穿刺针。当针尖到达目标部位后，用空芯针抽取数次（3-5 份）以确认针位正确。将提取的材料置于福尔马林中。对于接受新辅助治疗的患者，或经放射科医师评估有指征者，介入操作后应放置标记夹（marker clip）。

适应证：

/ US 见可疑（BI-RADS 4a、4b、4c-5）病变。

/ 腋窝淋巴结评估。

优点：

+ 操作简单、安全、快速。
+ 低成本和高可用性。

缺点：

− 为获取后续标本通常需再次进针（多次穿刺）。
− 假阴性率 1.2%-3.3%。

>-< 进阶知识

假阴性率为 1.2% 至 3.3%（平均 2%）。

/ Vacuum-Assisted Biopsy

Vacuum-Assisted Biopsy (VAB) provides material for histopathological analysis.

/ **Principle:** performed with a needle from 12 to 7 gauge, after local anaesthesia under mammography/tomosynthesis/CEM, US and MRI guidance. A special needle connected to a vacuum-generating device is inserted, through a small skin incision. Once the needle is in the target the vacuum attracts the tissue towards the needle and a rotating device cuts the samples remaining in site. Post interventional marker placement is encouraged.

ADVANTAGES:

+ Rapid removal of larger amount of tissue (1g).
+ Multiple samples without removing the needle.
+ Risk of lesion displacement reduced.

DISADVANTAGES:

– Moderate rate of complications.
– Cost and availability (MRI and CEM guidance).

Indications:

/ Suspicious microcalcifications or architectural tissue distortion on mammography/tomosynthesis.
/ Contrast-enhancing lesions on MRI, not visible with conventional imaging.
/ Radiologic-pathologic discordance after CNB.

>-< FURTHER KNOWLEDGE

False negative rate ranges from 1.2 to 3.3% (mean 2%).

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 真空辅助活检

真空辅助活检 (VAB) 可以为组织病理学分析提供材料。

/ **操作方式：**在乳腺 X 线摄影/断层合成/CEM、US 和 MRI 引导下局部麻醉后，使用 12 至 7 号穿刺针进行操作。经皮微小切口置入与真空生成装置连接的专用针头。当针头到达目标位置后，通过真空将组织吸引至针头，同时旋转切割装置以从该部位获取样本。建议在介入操作后放置定位标记。

适应证：

/ 乳腺 X 线摄影/断层合成显示可疑的微钙化或结构组织变形。
/ 常规影像学检查不可见，但 MRI 对比增强可见的病变。
/ CNB 后的放射学-病理学不一致。

优点：

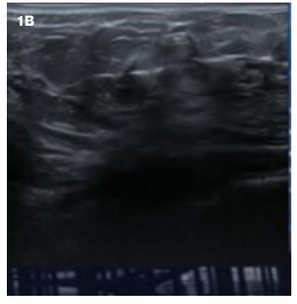
+ 快速去除大量组织 (1 g)。
+ 无需移除针头即可采集多份样本。
+ 病变移位风险低。

缺点：

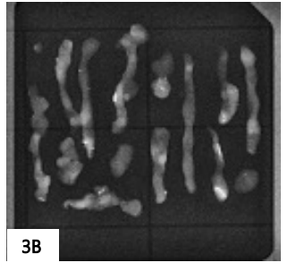
– 并发症发生率中等。
– 高成本和低可用性（MRI 和 CEM 引导）。

>-< 进阶知识

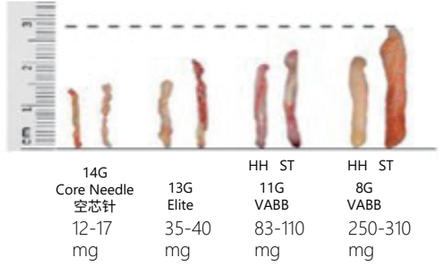
假阴性率为 1.2% 至 3.3%（平均 2%）。



US-VABB. Ultrasound-guided vacuum assisted breast biopsy. The patient is in supine position. After local anesthesia the VABB device is inserted through the skin toward the target by means of US guidance (**1A**). The needle is working under the lesion and can take multiple samples without being removed from the breast (**1B**).



Tomosynthesis-VABB. The patient is in prone position on the dedicated horizontal table. The location of the lesion is calculated through the system and the needle is automatically brought to the exact position (**3A**, post-fire 2D image). Radiography of the specimens shows the presence of microcalcifications and confirms the adequate sampling (**3B**). Histological examination revealed a poorly differentiated G3 in situ ductal carcinoma.



Average weight and size of biopsy samples obtained with different needle gauges. (Adapted from La Forgia et al, Diagnostics, 2020).

<!> ATTENTION

The most important step to avoid false negative results is systematic radiologic-pathologic correlation.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

US-VABB。超声引导下真空辅助乳腺活检。患者处于仰卧位。局部麻醉后，在 US 引导下将 VABB 器械经皮肤插入目标部位 (**1A**)。穿刺针定位于病灶下方，无需退出乳房即可完成多次取样 (**1B**)。

使用不同针号 (G) 的穿刺针获取之活检标本的平均重量与尺寸。(摘自 La Forgia 等人，Diagnostics，2020)。

断层合成-VABB。患者采取俯卧位，平躺于专用的水平操作台上。病变位置经系统计算后，穿刺针自动精确就位 (**3A**，击发后 2D 图像)。标本的 X 线摄影显示存在微钙化，并确认取样充分 (**3B**)。组织学检查发现低分化 G3 原位导管癌。

<!> 注意

避免假阴性结果的最重要步骤是建立系统性的影像学-病理学关联。

/ Vacuum-Assisted Excision

Vacuum-Assisted Excision (VAE) provides material for histopathological analysis

/ Technique: VABB devices with a collection of approximately 4 g of tissue (12-18 x 7 Gauge cores)

Indications:

/ B3 lesions found at first-attempt diagnostic VAB.

/ The practice across Europe and UK regarding the role of VAE in managing B3 lesions remains variable.

/ In 2016, the first international guidelines from Europe were published regarding the management of B3 lesions, and this was recently updated in 2019. For details refer to these documents.

ADVANTAGES:

+ Reduced surgery.
+ Reduced hospitalisation and cost.
+ Better cosmetic results.
+ Reduced risk of complications.

DISADVANTAGES:

– Underestimation of malignancy in excised B3 lesions ranges from about 10 to 35%.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 真空辅助切除术

真空辅助切除术 (VAE) 可以为组织病理学分析提供材料

/ 技术：使用 VABB 器械（12 ~ 18 × 7 号针）收集约 4 g 组织

适应证：

/ 首次尝试诊断性 VAB 时发现的 B3 病变。

/ 欧洲及英国关于 VAE 在 B3 病变治疗中的应用仍存在差异。

/ 2016 年，欧洲发布了首个针对 B3 病变管理的国际指南，并于 2019 年进行了更新。详细信息参见上述文件。

优点：

+ 减少手术需求。
+ 减少住院天数和费用。
+ 外观/美容结局更佳。
+ 降低并发症风险。

缺点：

– 切除的 B3 病变中，恶性低估率为 10% 至 35%。

/ Pre-Operative Image-Guided Localisation

Non palpable breast lesions need image-guided preoperative localisation, allowing for a safe and effective complete removal (clear margins) and cosmetic result. There is no clear evidence to support one guided technique over another with similar feasibility rate. Local policies and resources guide the choice.

>-< FURTHER KNOWLEDGE

Current options

- **Carbon marking**
  Long standing methods. Surgery up to 1 month after.
- **Wire localisation**
  Most commonly used method
  Safe and cost effective. Surgery within 24 h after. Possible rupture/migration.
- **Radio-guided localisation**
  Surgery within 24 h after. Radiation exposure. Higher cost and complex logistics.
- **Radioactive seed localisation**
  Longer interval time admitted between procedure and surgery. Radiation exposure. Higher cost.
- **Magnetic seed localisation**
  Surgery up to 1 month after. Higher cost. Artefact in Breast MRI.

/ 术前影像引导定位

对于不可触及的乳腺病变，需在影像引导下进行术前定位，以确保安全、完整切除（边缘清晰）并获得更佳效果。目前尚无明确证据表明某种引导技术更具优势（各技术可行性相近），具体选择应依据当地政策及资源情况。

>-< 进阶知识

当前方案

- **碳标记**
  成熟的方法。操作后最长间隔 1 个月内手术。
- **导丝定位**
  最常用的方法
  安全且性价比高。操作后 24 小时内需手术。可能存在导丝断裂或移位的风险。
- **放射引导下定位**
  操作后 24 小时内需手术。存在辐射暴露风险。成本较高且流程复杂。
- **放射性粒子定位**
  定位操作与手术之间可允许更长的间隔。存在辐射暴露风险。成本较高。
- **磁性粒子定位**
  操作后 1 个月内手术。成本较高。乳房 MRI 中可能产生伪影。

/ Minimal Invasive Therapy: a Goal for the Future

These treatments can achieve local tumour ablation through various types of energy that destroy tumour cells in different ways

- / Radiofrequency
- / Microwaves
- / Laser ablation

> Electromagnetic waves

- / Cryoablation

> Cooling

- / High-intensity focus ultrasound (HIFU)

> Mechanical waves

Indications:

- / B3 lesions found at first-attempt diagnostic VAB.
- / The practice across Europe and UK regarding the role of VAE in managing B3 lesions remains variable.
- / In 2016, the first international guidelines from Europe were published regarding the management of B3. .lesions, and this was recently updated in 2019. For details refer to these documents.

POTENTIAL ADVANTAGES:

+ Local anaesthesia.
+ Reduced hospitalisation and cost.
+ Better cosmetic results.
+ Reduced risk of complications.

LIMITATIONS:

– Lack of pathological examination of the entire lesion.
– Large/multicentric tumours.
– Tumours close to skin/muscle.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 微创治疗：面向未来的目标

这些治疗技术通过不同形式的能量，以不同机制破坏肿瘤细胞，从而实现局部肿瘤消融：

- / 射频
- / 微波
- / 激光消融术

> 电磁波

- / 冷冻消融术

> 冷冻消融

- / 高强度聚焦超声 (HIFU)

> 机械波

适应证：

- / 首次尝试诊断性 VAB 时发现的 B3 病变。
- / 欧洲及英国关于 VAE 在 B3 病变治疗中的应用仍存在差异。
- / 2016 年，欧洲发布了首个针对 B3 病变管理的国际指南，并于 2019 年进行了更新。详细信息参见上述文件。

潜在优点：

+ 仅需局部麻醉。
+ 减少住院天数和费用。
+ 外观/美容结局更佳。
+ 降低并发症风险。

局限性：

– 无法对整块病灶进行病理学检查。
– 不适用于体积较大或多灶/多中心性肿瘤。
– 不适用于邻近皮肤/肌肉的肿瘤。

Screening

筛查

Breast Imaging

乳腺影像学

CHAPTER OUTLINE:

章节大纲：

/ Why screen? - The Basics

<!> ATTENTION

/ **Early cancer detection** increases the probability of **successful treatment**.

/ The **aim of breast cancer screening** programmes is to reduce breast cancer mortality by early detection and early treatment of asympomatic cancer.

/ **Screening mammography in national screening programmes** includes mammography performed every 1, 2 or 3 years from the age of 40–50 years until around 70–75.

<!> ATTENTION

/ **European guidelines** suggest the 2-year interval for the general female population from 50 to 70 years of age & every 2 or 3 years for women aged 45 to 49 years.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 为什么要进行筛查? - 基础篇

<!> 注意

/ **癌症早期检测**能够提高**治疗成功**的概率。

/ **乳腺癌筛查**项目旨在通过无症状癌症的早发现、早治疗，降低乳腺癌相关死亡率。

/ **国家筛查项目中的筛查性乳腺 X 线摄影**的对象包括从 40-50 岁到 70-75 岁左右的女性，筛查频率在 1、2 或 3 年一次不等。

<!> 注意

/ **欧洲指南**建议：50 至 70 岁普通女性人群的筛查间隔为 2 年，45 至 49 岁女性则为每 2 或 3 年一次。

Wilson & Junger Outlined 10 Criteria for Screening

1. The condition screened for should be an IMPORTANT one
2. There should be an ACCEPTABLE TREATMENT for the disease
3. DIAGNOSTIC & TREATMENT facilities should be available
4. A RECOGNISABLE LATENT or EARLY SYMPTOMATIC stage is required
5. There should be an AGREED POLICY on who to treat
6. The test must be of HIGH DISCRIMINATORY POWER, VALID (measuring what it proposes to measure) & be REPRODUCIBLE
7. The test must be ACCEPTABLE to the client being screened
8. The NATURAL HISTORY of the untreated disease should be adequately understood
9. The COST of case-finding (diagnosing and treating patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole
10. Screening is a CONTINUOUS PROCESS

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

Wilson & Junger 总结了 10 项筛查标准

1. 筛查目标疾病应该是“重要疾病”
2. 该疾病应具有可接受的治疗手段
3. 诊断与治疗条件（设施与能力）应当可获得
4. 疾病应当存在可识别的潜伏期或早期有症状阶段
5. 对哪些患者需要治疗应当有一致认可的政策
6. 检测必须具备良好的区分效度、有效性（准确反映目标测量指标）和重复性
7. 该检测方式应当为受检者所能接受
8. 需充分了解未干预状态下疾病的自然病程
9. 个案发现（诊断与治疗确诊患者）成本需与整体医疗支出保持经济平衡
10. 筛查是一个持续的过程

Risk Factors

A **risk factor** is defined as anything that affects an individual' s chance of getting a disease.

Certain major risk factors for breast cancer are beyond an individual' s control.

Simply **being a woman** is the main risk factor for breast cancer.
Breast cancer is about 100 times more likely to occur in women than in men.

Aging inevitably increases the risk of developing breast cancer. Almost 8 out of 10 women diagnosed are over the age of 50. Breast cancer is rare in women under 30 years old.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

风险因素

风险因素是指任何可能影响个体罹患疾病概率的因素。

某些乳腺癌主要风险因素超出个人可控范围。

仅**女性**性别本身就是乳腺癌的首要风险因素。
乳腺癌在女性中的发病率约为男性的 100 倍。

衰老会不可避免地增加罹患乳腺癌的风险。每 10 例乳腺癌确诊患者中，约有 8 例年龄超过 50 岁。该疾病在 30 岁以下女性群体中较为罕见。

Factors Associated with an Increased Risk of Breast Cancer

- Family history.
- Early menarche (age < 12 years).
- Late first pregnancy (after age 28 years).
- Current use of an Oral Contraceptives Pill (OCP) and for 10 years later Nulliparity.
- Late menopause.
- Prolonged use of Hormone Replacement Therapy (HRT).
- Significant weight gain in adult life.
- Sedentary lifestyle.
- Increased mammographic breast density.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

与乳腺癌风险增加相关的因素

- 家族史。
- 初潮过早（年龄<12 岁）。
- 首次妊娠时间较晚（28 岁以后）。
- 当前服用口服避孕药 (OCP) 及后续 10 年未生育。
- 绝经期较晚。
- 长期使用激素替代疗法 (HRT)。
- 成年后体重显著增加。
- 久坐。
- 乳腺 X 线摄影显示乳腺密度增加。

/ Age & Risk of Breast Cancer

Risk up to and including age 29 years	1 in 2000
Risk up to and including age 39 years	1 in 315
Risk up to and including age 49 years	1 in 50
Risk up to and including age 59 years	1 in 22
Risk up to and including age 69 years	1 in 13
Lifetime Risk	1 in 8

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 不同年龄段的乳腺癌风险

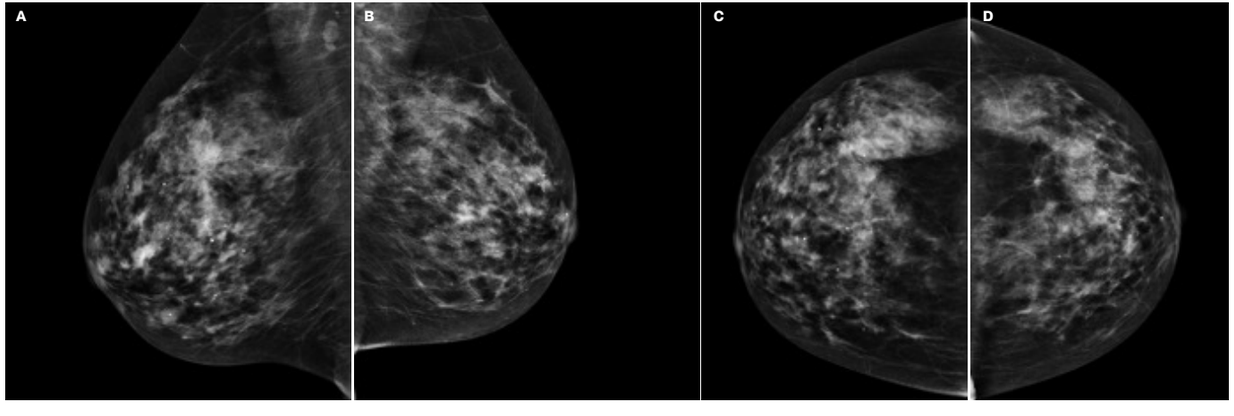
29 岁及以下的风险	1/2000
39 岁及以下的风险	1/315
49 岁及以下的风险	1/50
59 岁及以下的风险	1/22
69 岁及以下的风险	1/13
终生风险	1/8

/ How to Screen?

Screening test:
THE MAMMOGRAM (direct digital acquisition)

<!> ATTENTION

Studies show that even when women have access to the latest therapies deaths from breast cancer decline at a much higher rate than women who get mammographic screening.



4 VIEWS: Right & Left Mediolateral oblique views (a,b) AND BilateralCraniocaudal views (c,d). Breast compressed between paddles.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 如何筛查?

筛查检测：
乳腺 X 线摄影（直接数字化成像）

<!> 注意

研究显示，即便在可获得先进治疗的情况下，接受乳腺 X 线摄影筛查者的乳腺癌死亡率较未筛查者下降更为显著。

4 个体位：右、左内外侧斜位（MLO；a、b）以及双侧头尾位（CC；c，d）。乳腺组织压迫于平板之间。

/ Limitations of Breast Screening

<!> ATTENTION

Interval cancer and false positive recalls

- Cancer may still develop in between one screening round and the next. Any symptoms which develop in the interim should not be dismissed without work-up.
- A number of screening clients may undergo additional tests (additional mammo views, ultrasonography with or without needle sampling) - and associated worry - which result in a benign diagnosis. The average risk of false positive recall of clients undergoing biennial screening aged 50-69 years has been calculated at 20%.

"Overdiagnosis"

- Some screen-detected breast cancers would have never otherwise been found and would not have become life-threatening. There is as yet no way to identify which breast cancers are not life-threatening and treatment is offered for all diagnosed breast cancers.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 乳腺筛查的局限性

<!> 注意

间期癌与假阳性召回：

- 癌症在筛查间期仍可能进展。间期出现的任何症状都不应在未评估情况下忽略，应进一步检查。
- 某些受检者或需接受额外的检查（额外的乳腺 X 线摄影（mammography，MX）加位、超声，可伴或不伴穿刺取样），这可能引起焦虑，但多数结果为良性病变。50-69 岁女性每两年接受筛查的假阳性召回平均风险为 20%。

"过度诊断"

- 部分通过筛查检出的乳腺癌，若不筛查原本不会被发现，且不会发展到危及生命。目前尚无法识别哪些乳腺癌不致命，因此临床对所有确诊乳腺癌均给予治疗。

<!> ATTENTION

Radiation penalty

- Mammography involves exposure of the breast tissue to ionising radiation (which is potentially carcinogenic).
- The effective dose for standard 2-view mammogram of each breast is 0.4mSV for digital mammography. (This may be comparable to 2 months of background radiation quoted at 3mSV per annum or the equivalent of under a third of the effective dose from a lumbosacral spine radiograph).
- The small risk of radiation-induced cancer in an organised and controlled breast screening programme is outweighed by the benefits of expected mortality reduction.

"Mammography of Dense Breast"

- Breast density is the measure of the proportion of glandular tissue Vs fatty tissue in a breast on mammography. The similar x-ray absorption of fibroglandular tissue and breast cancers results in potential masking of breast cancers on mammography in denser breasts.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

<!> 注意

辐射风险说明

- 乳腺 X 线摄影会使乳腺组织暴露于电离辐射（可能致癌）。
- 数字乳腺 X 摄影中，单侧乳腺标准双体位投照的有效辐射剂量为 0.4 mSV。（这可能相当于 2 个月的本底辐射量（按每年 3 mSV 计算），不足腰椎骶椎 X 线检查三分之一的等效剂量）。
- 在规范管理的乳腺筛查项目中，辐射诱发癌症的微小风险远低于预期降低死亡率的获益。

“致密型乳腺的乳腺 X 线摄影”

- 乳腺密度是乳腺 X 线摄影中乳腺腺体组织与脂肪组织比例的衡量指标。由于纤维腺体组织与乳腺癌具有相似的 X 线吸收特性，在致密型乳腺中可能掩盖乳腺癌的显示。

High Risk Women

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

高风险女性

/ Introduction

<!> ATTENTION

- All national breast cancer screening programs offer the same imaging to every eligible woman except where there is evidence of increased risk factors for developing breast cancer.
- Risk for breast cancer is calculated based on age, genetic testing, family history of breast and ovarian cancer, and clinical history (personal history of breast cancer, chest radiation, history of a breast biopsy with atypical epithelial proliferations in the breast, and extremely dense breasts.
- Women can be classified as being at average, intermediate and high lifetime risk of developing breast cancer.
- Women at **average risk** are considered those with a lifetime risk developing breast cancer of < 15%.
- Women at **intermediate risk** are considered those with a lifetime risk developing breast cancer ranged between 15% and 20%, a personal history of breast cancer, dense breasts at mammography or a history of high-risk lesions at biopsy (specifically, atypical ductal hyperplasia, atypical lobular hyperplasia, and lobular carcinoma in situ).
- Women at **high risk** are considered those with a lifetime risk developing breast cancer of > 20%.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 简介

<!> 注意

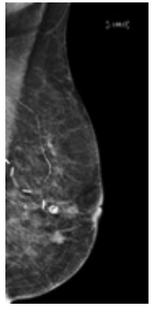
- 除存在明确乳腺癌高危因素的个体外，各国乳腺筛查项目均对符合筛查条件的女性采用统一的影像学检查方案。
- 乳腺癌风险评估主要基于以下因素：年龄、基因检测结果、乳腺癌/卵巢癌家族史，以及临床病史（包括乳腺癌个人史、胸部放射治疗史、乳腺活检发现非典型上皮增生病变史，以及致密型乳腺）。
- 女性罹患乳腺癌的终生风险可分为平均风险、中等风险和高风险。
- **平均风险**女性罹患乳腺癌的终生风险 < 15%。
- **中等风险**女性是指乳腺癌终身风险介于 15% 至 20% 之间、有乳腺癌个人史、乳腺 X 线摄影显示致密型乳腺或活检发现高风险病变（特别是非典型导管增生、非典型小叶增生和小叶原位癌）的女性。
- **高风险**女性罹患乳腺癌的终生风险 > 20%。

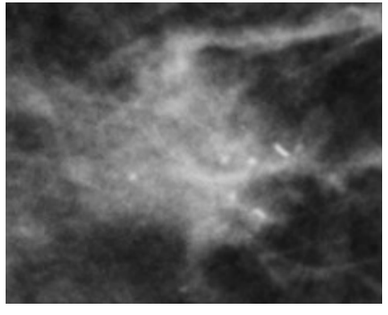
Personal History of Breast Cancer: Screening

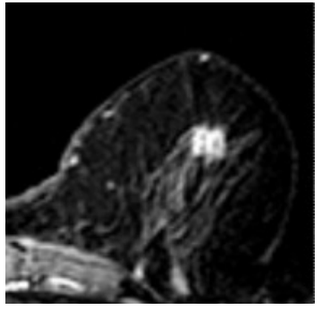
<!> ATTENTION

Women with a personal history of breast cancer are at a substantially increased risk for the development of a recurrence or second breast cancer.

The sensitivity of mammography for early detection of second breast cancers is slightly reduced due to postoperative changes, including scar formation and dystrophic calcifications.







- Annual breast MRI as an adjunct to mammography for women with a previous breast cancer diagnosis at an age younger than 50 years is now recommended in the USA.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

乳腺癌个人史：筛查

<!> 注意

有乳腺癌个人史的女性，其复发或发生第二原发乳腺癌的风险显著增加。

由于术后改变（包括瘢痕形成和营养不良性/退行性钙化），乳腺 X 线摄影对第二原发乳腺癌早期检测的敏感性略有降低。

- 目前美国建议，对于 50 岁前确诊乳腺癌的女性，除乳腺 X 线摄影外，还应每年进行乳腺 MRI 检查。

/ History of Atypical Epithelial Proliferations in the Breast

Women with history of atypical epithelial proliferation such as atypical ductal hyperplasia (ADH), atypical lobular hyperplasia (ALH), and lobular carcinoma in situ (LCIS) have a relative risk of 3 to 10 times higher of developing breast cancer compared with the general population.

- If left in the breast, these lesions might develop into a ductal carcinoma in situ (DCIS) or invasive carcinoma although the progression to malignancy is low and occurs over a long period (PPV 10-15%);
- The risk to develop breast cancer in the same or contralateral breast is respectively 3.8% to 3.7% at 10 years, 8.9% to 8.6% at 15 years and 30.5% to 26.2% at 25 years from the diagnosis.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 乳腺非典型上皮增生病史

有非典型上皮增生病史的女性，例如非典型导管增生 (ADH)、非典型小叶增生 (ALH) 和小叶原位癌 (LCIS) 患者，罹患乳腺癌的相对风险较一般人群增加 3-10 倍。

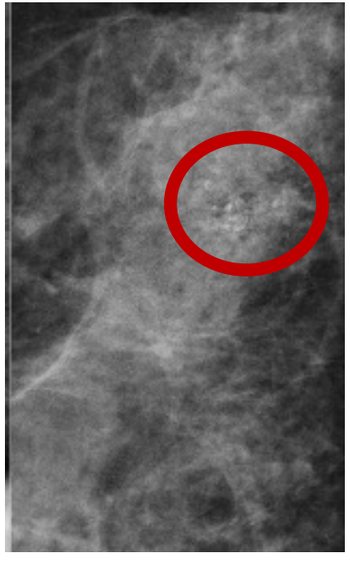
- 如果这些病灶留在乳房中，可能发展为导管原位癌（ductal carcinoma in situ，DCIS）或浸润性癌，但其进展为恶性肿瘤的概率较低且进展时间较长 (PPV 10%～15%)；
- 在诊断后 10 年、15 年和 25 年，同侧或对侧乳房发生乳腺癌的风险分别为 3.8% vs 3.7%、8.9% vs 8.6% 和 30.5% vs 26.2%。

HIGH RISK LESION	IMAGING FINDINGS
Atypical Ductal Hyperplasia (ADH)	Fine pleomorphic microcalcifications and linear or segmental distribution. As an irregular-shaped small hypoechoic mass with micro-lobulated edges.
Lobular Neoplasia (LN)	Amorphous microcalcifications and grouped distribution.

<!> ATTENTION

Currently, annual screening mammography with consideration for annual MRI in women with history of atypia, especially if other risk factors are present is indicated.

Modified from Catanzariti F. et al (2021)



Atypical Ductal Hyperplasia (ADH)

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

高危病变	影像学表现
非典型导管增生 (ADH)	多型性微钙化，呈线样或段样分布。为边缘呈微分叶状的不规则低回声小肿块。
小叶肿瘤 (LN)	无定形微钙化，成组分布。

<!> 注意

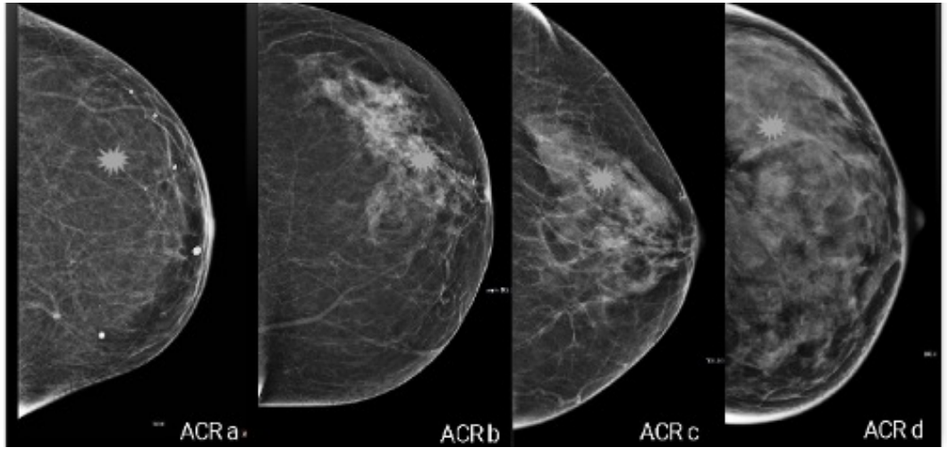
目前，对于有非典型上皮增生病史的女性，应每年进行一次乳腺 X 线摄影筛查，并考虑每年进行一次 MRI 检查，如合并其他危险因素，MRI 的适用性更强（更推荐）。

改编来源：Catanzariti F. et al (2021)

非典型导管增生 (ADH)

/ Extremely Dense Breast: Masking Effect

The fibro-glandular tissue, commonly referred as “dense tissue”, absorbs ionising radiation and projects white on mammography like most cancers that appear white on mammography.



<!> ATTENTION

Cancers could therefore be hidden by dense (white) tissue.

This means that dense tissue may prevent - “mask” - the detection on mammography.

This is the so called “**masking effect**”.

/ Breast Imaging

CHAPTER OUTLINE:

/ 极度致密乳腺：掩蔽效应

纤维腺体组织通常被称为“致密组织”，可吸收电离辐射，在乳腺 X 线摄影中，这种组织会像大多数肿瘤组织一样呈现白色。

<!> 注意

因此，肿瘤组织可能被致密的（白色）组织掩蔽。

换言之，这些致密的组织可能阻止（“掩蔽”）乳腺 X 线摄影对病变的检测。

这就是所谓的“**掩蔽效应**”。

/ 乳腺 影像学

章节大纲：

/ Extremely Dense Breast: Independent Risk Factor

<!> ATTENTION

Besides the risk of masking breast cancer, breast density is also one of the strongest known **independent risk factor** for developing breast cancer.

/ Dense breast tissue is common in women, with 31%-43% of the general screening population having heterogeneously dense (c) or extremely dense breasts (d) on mammography.

/ Women with extremely dense breast (d) had a 4.6-fold increased breast cancer risk (95% confidence interval, 3.6-5.9) compared with women with fatty breasts.

/ This is due to both the absolute higher amount of fibro-glandular tissue within the breast and the breast composition.

/ Breast Imaging

CHAPTER OUTLINE:

/ 极度致密乳腺：独立风险因素

<!> 注意

除了掩蔽乳腺癌的风险之外，乳腺密度还是已知致人罹患乳腺癌的**最强独立风险因素**之一。

/ 致密型乳腺组织在女性中很常见，一般筛查人群中有 31%～43% 的人在乳腺 X 线摄影检查中可见乳房密度不均 (c) 或极度致密乳腺 (d)。

/ 与脂肪型乳腺女性女性相比，极度致密乳腺女性 (d) 罹患乳腺癌的风险高 4.6 倍（95% 置信区间，3.6-5.9）。

/ 这既与乳房内腺体（纤维腺体）组织的绝对含量较高有关，亦与乳腺整体组织构成相关。

/ 乳腺影像学

章节大纲：

/ Extremely Dense Breast: Screening

<!> ATTENTION

In women with extremely dense breast tissue the sensitivity of digital mammography (DM) screening is about 62–68% compared to 86 to 89% in women with fatty breasts.

The use of digital breast tomosynthesis (DBT) has increased the cancer detection rates by 20 to 40% in women with dense breasts.

However, both DM and DBT seem to be heavily affected by breast density and thus lead to underdiagnosis of relevant cancers in these women.

The added value of supplemental ultrasound regarding cancer detection is limited, especially concerning the high number of false positive examinations.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 极度致密乳腺：筛查

<!> 注意

在极度致密乳腺女性中，数字乳腺 X 线摄影（digital mammography，DM）筛查的敏感性约为 62–68%；而在脂肪型乳腺女性中约为 86–89%。

得益于数字乳腺断层合成摄影（digital breast tomosynthesis，DBT）的应用，可使致密乳腺女性的癌症检出率提高约 20–40%。

然而，DM 和 DBT 均显著受乳腺密度影响，因此在该人群中仍可能低估（漏诊）相关癌症。

在癌症检测中，辅助超声检查发挥的附加价值很有限，尤其是考虑到其假阳性检查数量较高。

<!> ATTENTION

/ Breast Imaging

/ 乳腺影像学

<!> 注意

The European Society of Breast Imaging (ESOBI) now recommends:

/ Women with extremely dense breasts should be appropriately informed about their density and on the diagnostic and prognostic implication of having dense breasts

/ Supplemental screening with breast MRI or breast MRI alone should be offered to women with extremely dense breast from age 50 to 70 years should preferably every 2 to 3 years

/ Supplemental ultrasound to mammography should be offered to women with dense breasts as an alternative to breast MRI when the MRI screening is not available

欧洲乳腺影像学会（European Society of Breast Imaging，ESOBI）当前的建议如下：

/ 应适当告知极度致密乳腺女性其乳腺密度，并说明致密乳腺在诊断与预后方面的含义。

/ 50–70 岁的极度致密乳腺女性，宜提供乳腺MRI筛查（可与乳腺X线摄影联合，或单独行 MRI），优选每 2–3 年一次。

/ 当 MRI 筛查不可及时，致密型乳腺的女性应接受乳腺 X 线摄影联合超声检查，作为乳腺 MRI 筛查的替代方案。

CHAPTER OUTLINE:

章节大纲：

/ High Risk Women

High-Risk are women with a lifetime risk equal to or higher than 20% of developing breast cancer in their life.

This includes women with:

/ Hereditary breast cancer

/ Familial Risk of breast and ovarian cancer

/ History of chest wall radiation at a young age

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 高风险女性

高风险是指女性一生中患乳腺癌的终生风险 ≥20%。

这包括存在以下情况的女性：

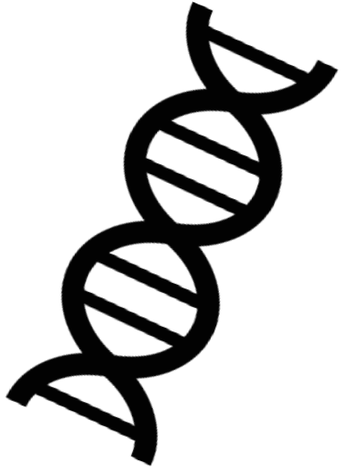
/ 遗传性乳腺癌

/ 乳腺癌和卵巢癌的家族性风险

/ 年轻时胸壁放疗史

Hereditary Breast Cancer

- Women diagnosed with breast cancers are carriers of a known genetic mutation in about 5-10% of cases.
- The presence of a BRCA1 or BRCA2 mutation accounts for the majority of hereditary breast and ovarian cancer syndromes.
- Other rarer gene mutations include TP53, PTEN, PALB2, STK11, CDH1, ATM, and CHECK2.
- More than 2000 different mutations have been identified in BRCA1/2 genes, and in some populations—for example in Ashkenazi Jewish- the prevalence of a BRCA 1 or BRCA2 mutation is higher.



Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

遗传性乳腺癌

- 被诊断为乳腺癌的女性中，约有 5-10% 的病例携带已知的基因突变。
- BRCA1 /BRCA2 突变构成多数遗传性乳腺癌-卵巢癌综合征的主要遗传学基础。
- 其他更罕见的基因突变包括 TP53、PTEN、PALB2、STK11、CDH1、ATM 和 CHECK2。
- BRCA1/2 基因中已发现 2000 多种不同的突变，在某些人群中（例如阿什肯纳齐犹太人），BRCA1 或 BRCA2 突变的发生率更高。

Hereditary and Familial Risk

Women diagnosed with a genetic mutation carry a breast cancer risk that is different for each mutation:

- For BRCA1 75–82%
- For BRCA2 76–82%
- For TP53 95% by 90 years old
- For PTEN 85% by 80 years old
- For CDH1 53% by 80 years old
- For STK11 32% by 60 years old

Among men harbouring a BRCA1 or BRCA2 mutation, there is an estimated lifetime risk of breast cancer of 1.2% to ⩽8%, respectively and a doubling of prostate cancer risk.

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

遗传性与家族性风险

携带不同致病基因突变的女性，其罹患乳腺癌的终生风险因基因而异：

- BRCA1：75–82%
- BRCA2：76–82%
- TP53：至 90 岁约 95%
- PTEN：至 80 岁约 85%
- CDH1：至 80 岁约 53%
- STK11：至 60 岁约 32%

据估计，携带 BRCA1 或 BRCA2 突变的男性罹患乳腺癌的终生风险分别约为 1.2% 与 ⩽ 8%，且罹患前列腺癌的风险翻倍。

/ Familial Risk of Breast and Ovarian Cancer

Patients with the following family histories of cancer, all on the same side of the family, are at increased risk and should be referred to Clinical Genetics:

- Three or more 1st or 2nd degree relatives with breast and / or ovarian cancer
- One 1st and one 1st or 2nd degree relative both with breast cancer or one with breast cancer and one with ovarian cancer
- Two 1st or 2nd degree relatives with ovarian cancer or one 1st or 2nd degree relative with breast cancer and one 1st or 2nd degree relative with either a sarcoma < 45, a glioma or a childhood adrenal cortical carcinoma
- A 1st degree relative with breast cancer under 40, or triple negative breast cancer under 60
- A 1st degree relative with bilateral breast cancer or with male breast cancer or with both breast and ovarian cancer
- Ashkenazi Jewish heritage with a 1st degree relative with breast cancer or ovarian cancer at any age

In the absence of a genetic mutation, the risk for women with a strong family history of breast cancer remains high, although somewhat lower compared to the one in whom a germline mutation is found.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 乳腺癌和卵巢癌的家族性风险

有以下癌症家族史（均来自家族同一侧系）的患者风险更高，应转诊至临床遗传学专科：

- ≥3 名一级或二级亲属患乳腺癌和/或卵巢癌
- 1 名一级亲属 + 1 名一级或二级亲属同时患乳腺癌，或一名亲属患乳腺癌、另一名亲属患卵巢癌
- 2 名一级或二级亲属患卵巢癌；或 1 名一级或二级亲属患乳腺癌，且 1 名一级或二级亲属患肉瘤 (< 45)、胶质瘤或儿童肾上腺皮质癌
- 1 名 40 岁以下一级亲属患乳腺癌，或 1 名 60 岁以下一级亲属患三阴乳腺癌
- 1 名一级亲属患双侧乳腺癌或男性乳腺癌，或同时患乳腺癌和卵巢癌
- 阿什肯纳齐犹太裔，有 1 名任何年龄段的一级亲属患乳腺癌或卵巢癌

即使未检出基因突变，具有明显乳腺癌家族史的女性仍属高风险，但其风险略低于检出胚系突变者。

/ High Risk Women: Screening

<!> ATTENTION

- For high-risk women, national and international guidelines are in favour of including dedicated pathways for screening, offering breast magnetic resonance imaging (MRI).
- International guidelines recommend screening high-risk women with yearly MRI from age 25 years onwards, and additional mammography from age 30 years.
- Due to the high tumour growth rate and shorter lead time of BRCA-related breast cancers, alternating MR imaging and mammographic screening examinations at 6-month intervals also may be a clinically effective approach.
- BRCA1/BRCA2 can choose between prophylactic bilateral mastectomy and ovariectomy, leading to a 90% risk reduction. Alternatively, they join screening programs.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 高风险女性：筛查

<!> 注意

- 对于高风险女性，国家/地区和国际指南支持纳入专门的筛查路径，提供乳腺 MRI 检查。
- 国际指南建议从 25 岁开始每年对高风险女性进行 MRI 筛查，并从 30 岁开始额外增加乳腺 X 线摄影检查。
- 由于 BRCA 相关乳腺癌的肿瘤生长速率较快且提前期更短，每 6 个月交替进行 MR 影像学检查和乳腺 X 线摄影检查也可能是一种临床有效的方案。
- BRCA1/BRCA2 突变携带者可以选择接受预防性双侧乳房切除术或卵巢切除术，总体风险可降低约 90%。亦可选择参加高风险筛查项目。

History of Chest Wall Radiation at a Young Age

- There is a substantially increased risk of breast cancer following chest irradiation and breast cancer in women is the leading cause of death in long-term survivors of Hodgkin lymphoma.
- Estimates of breast cancer are highest among women treated before the age of 30 years, due to the known sensitivity of breast tissue to radiation at younger ages.
- The cumulative risk increases with the radiation dose delivered, volume of the radiation field, and time interval since completion of the radiation therapy.
- The incidence of breast cancer increases after approximately 8 years following chest irradiation, and by the age of 40–45 years, 13%–20% of women treated with moderate- to high-dose chest irradiation for a paediatric cancer will be diagnosed with breast cancer.

<!> ATTENTION

Screening

- Females irradiated below the age of 10 years- additional screening is not applicable to these females.
- Females irradiated between ages of 10 and 19 are eligible for MRI screening annually from age 20 to < 71 years old. Surveillance starts at 25 or 8 years after first irradiation;
- Females irradiated between ages of 20 and 29 are eligible for MRI screening annually from age 30 to 39 years, and from age 40 to < 71 annual MRI and mammographic screening;

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

年轻时胸壁放疗史

- 接受胸部放疗后发生乳腺癌的风险显著增加，并且在女性霍奇金淋巴瘤的长期生存者中，乳腺癌是主要死因
- 据估计，30 岁前接受过胸部放疗的女性的乳腺癌发病率最高，因年轻时乳腺组织对辐射更敏感。
- 累积风险随辐射剂量、放疗靶区体积及距放疗结束的时间延长而增加。
- 患者接受胸部放疗后大约 8 年，乳腺癌的发病率开始升高，到 40-45 岁时，曾因罹患儿科癌症接受中到高剂量胸部放疗的女性中，约有 13-20% 将被诊断为乳腺癌。

<!> 注意

筛查

- 10 岁以前接受过放疗的女性 - 额外筛查不适用于这类女性。
- 10-19 岁接受过放疗的女性可从 20 岁开始到 < 71 岁每年行乳腺 MRI 筛查。从 25 岁或首次放疗后满 8 年开始监测；
- 在 20-29 岁之间接受放疗的女性可从 30 岁开始到 39 岁每年接受一次 MRI 筛查，从 40 岁开始到 < 71 岁每年接受一次 MRI 联合乳腺 X 线摄影筛查；

Communi-cation

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

沟通

/ Communication and Attendance to Screening

As breast imaging has become an important subspecialty of radiology, it has evolved into a more clinically oriented discipline.

There is far greater need for direct contact and communication with the patient about procedures, diagnoses, management options and follow-up recommendations.

There is now a greater emphasis on the need to understand the potential influences of communication to encourage ongoing participation in screening mammography.

<!> ATTENTION

In symptomatic patients > 40 years of age – mammographic assessment may be considered the first-line modality for breast assessment.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 沟通和筛查参与情况

随着乳腺影像学成为放射学的一个重要亚专业，其学科更趋临床导向。

在操作流程、诊断结论、处理方案与随访建议方面，与患者直接沟通的需求显著增加。

理解沟通可以产生的潜在影响很有必要，医疗人员现在越来越重视这种需求，积极鼓励人们持续参与乳腺 X 线摄影筛查。

<!> 注意

对于 > 40 岁的有症状患者 – 乳腺 X 线摄影可作为一线评估手段。

/ What should be considered prior to booking a Mammogram appointment?

Premenopause

The correct time to schedule an appointment is day 7-12 of menstrual cycle.

Mammographic sensitivity is NOT limited by menstrual cycle – but tolerance of mammographic compression may be increased. Symptomatic patients may consider waiting for their period to see if symptoms are cycle related and may resolve.

Mammography is not performed in pregnancy and lactation.

Postmenopausal

No scheduling limitations save for consideration of interim since previous mammographic work-up.

If available, patient should take any previous breast imaging copies and reports for comparison.

/ 预约乳腺 X 线摄影检查前的注意事项有哪些？

绝经前女性

正确的预约时间是月经周期的第 7-12 天。

乳腺 X 线摄影的敏感性不受月经周期限制，但在某些周期时段，受检者对压迫的耐受性通常更好。有症状的患者可考虑等待月经来潮，以观察症状是否与月经周期相关并可能自行缓解。

妊娠期与哺乳期一般不进行乳腺 X 线摄影。

绝经后女性

除考虑与上次乳腺 X 线摄影检查之间的间隔外，无特殊预约时间限制。

如有既往乳腺影像检查片与报告，建议随身携带以便对照。

/ Can a cancer be missed on Mammography?

Mammography is not a perfect test.

Up to 28% of cancers can be missed – particularly in premenopausal women and in those with dense breasts.

<!> ATTENTION

Breasts symptoms should be given appropriate consideration despite a recent negative screening mammogram.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 乳腺 X 线摄影检查会漏诊癌症吗？

乳腺 X 线摄影并非完美的检查手段。

最高可达 28% 的漏诊率，尤其是绝经前女性和致密型乳腺女性。

<!> 注意

即使近期的乳腺 X 线摄影筛查结果为阴性，乳房出现症状时仍应予以适当重视。

When is Breast Ultrasound Recommended?

<!> ATTENTION

Ultrasound is an established tool for the work-up of suspected cancers.

It is the breast imaging method of choice in women under 40 years of age.

The European Society of Breast Imaging (EUSOBI) outlines the following definite indications for Breast Ultrasound:

- Palpable lump
- Axillary adenopathy
- First approach for clinical breast abnormalities under age 40Y
- First approach for clinical breast abnormalities in pregnant or lactating women
- Suspicious abnormalities at mammography or MRI
- Suspicious nipple discharge
- Recent nipple inversion
- Skin retraction
- Breast inflammation
- Abnormalities at the surgical scar after breast conserving surgery or mastectomy
- Abnormalities in the presence of Breast Implants
- Screening high-risk women, especially when MRI is not performed
- Guidance for percutaneous breast interventions (needle biopsy, pre-surgical localisation, fluid collection drainage)
- Monitoring patients with breast cancer receiving neo-adjuvant therapy, when MRI is not performed

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

在什么情况下建议接受乳腺超声检查？

<!> 注意

超声是对疑似癌症进行诊断评估的成熟工具。

对 40 岁以下女性，乳腺超声为首选影像学检查。

EUSOBI 概述了乳腺超声检查的明确适应证如下：

- 可触及肿块
- 腋窝淋巴结肿大
- 40 岁以下临床乳房异常者的首选检查方案
- 妊娠期或哺乳期临床乳房异常女性的首选检查方案
- 乳腺 X 线摄影或 MRI 发现可疑异常
- 可疑乳头溢液
- 新近出现乳头内陷
- 皮肤回缩
- 乳腺炎症
- 保乳术后或乳房切除术后手术瘢痕处异常
- 乳房植入物在体情况下的异常
- 高风险女性的筛查（特别是在无法实施 MRI 时）
- 经皮乳腺介入的影像引导（穿刺活检、术前定位、积液引流）
- 在未进行 MRI 的情况下对接受新辅助疗法的乳腺癌患者进行随访监测

/ Can breast US be performed instead of mammography for breast cancer screening?

<!> ATTENTION

Ultrasound may seem as a safe alternative to mammography – as it does not involve exposure to ionising radiation.

However, US has not been shown to reduce mortality from breast cancer in the general female population.

If US is used as a stand-alone screening tool instead of mammography, cancers could be missed, particularly in fatty breasts.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺癌筛查能否以乳腺超声 (US) 替代乳腺 X 线摄影?

<!> 注意

超声检查可以看作是乳腺 X 线摄影的安全替代方案，因为它不涉及电离辐射暴露。

然而，在一般女性中，US 尚未被证实可以降低乳腺癌死亡率。

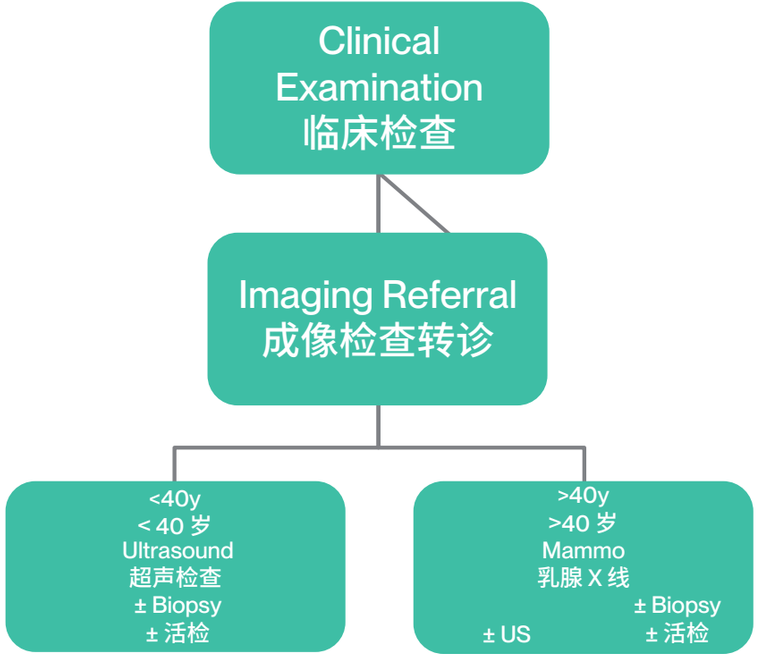
如果 US 取代乳腺 X 线摄影成为独立的筛查工具，可能导致癌症漏诊，尤见于脂肪型乳腺。

/ 乳腺 影像学

章节大纲：

/ Triple Assessment

Triple Assessment Schematic of the Symptomatic Breast Patient – may be performed as part of a One Stop Clinic



/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 三联评估

有症状乳腺患者的“三联评估”流程示意——可作为一站式门诊 (One-Stop Clinic) 的一部分实施

Breast Imaging Scenarios: Screening & Diagnostic

Imaging of the breast may be:

Screening of an asymptomatic cohort of clients assessed to pick up early disease changes

Breast screening is discussed in a dedicated chapter of this eBook.

Diagnostic:

Work-up of

- A clinical finding eg lump, nipple changes or discharge, skin dimpling, breast inflammation
- An incidental finding (breast finding on CT/MRI/PET Scan performed for a non-breast related indication)

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

乳腺影像学检查场景：筛查和诊断

乳腺影像学检查可用于：

筛查针对无症状人群，旨在发现早期病变改变

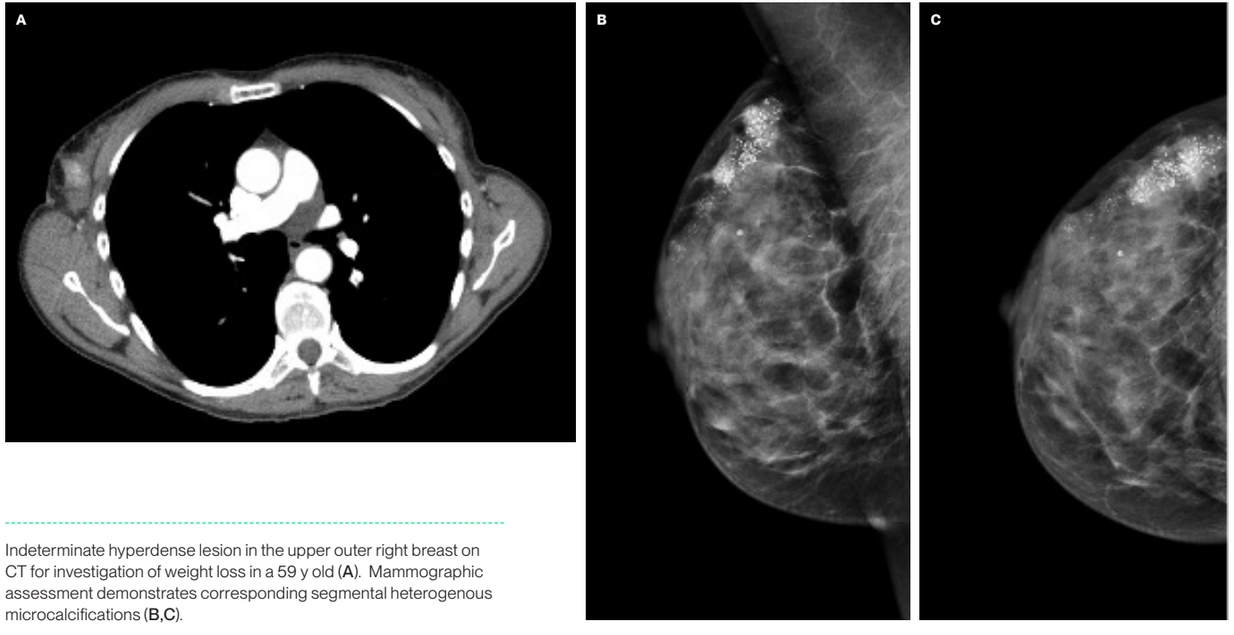
本电子书有另设章节专门讨论乳腺筛查。

诊断：

诊断评估

- 临床表现，如肿块、乳头变化或溢液、皮肤凹陷、乳腺炎症
- 偶然发现（因非乳腺相关适应证进行的 CT/MRI/PET 扫描中的乳腺相关结果）

Breast Imaging may be required as part of work-up for Incidental Breast findings on other imaging



Indeterminate hyperdense lesion in the upper outer right breast on CT for investigation of weight loss in a 59 y old (**A**). Mammographic assessment demonstrates corresponding segmental heterogenous microcalcifications (**B**,**C**).

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

对于其他影像学检查中偶然发现的乳腺相关结果，可能需要将乳腺影像学检查作为诊断评估的一部分

1 例 59 岁的患者因体重减轻接受 CT 检查，右乳腺外上象限发现一不确定的高密度病灶 (**A**)。乳腺 X 线摄影评估显示存在相应节段性异质性微钙化 (**B**,**C**)。

/ Basic Considerations in Communicating with Patients

<!> ATTENTION

- Diagnostic breast imaging studies frequently reveal the need to obtain a definitive histological diagnosis.
- The radiologist interprets the images, determines the need and performs the biopsy.
- The radiologist receives the pathological results, determines concordance of the tissue diagnosis with the imaging concern and guides the patient toward the most appropriate treatment.
- The radiologist is also uniquely positioned to enhance the patient's understanding and acceptance of the pathological findings with gentle and artful optimism.
- To communicate with patients in order explain the benefits, risk and basic technical aspects of diagnostic imaging of the breast.
- To communicate the benefits and risks of mammography screening.
- To be able to communicate the results of a breast imaging examination, whenever necessary under supervision, to patients and their families based on the radiologic report by the end of the medical studies.
- To be able to correctly suggest the most appropriate imaging examination depending on the clinical situation.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 与患者沟通的基本注意事项

<!> 注意

- 诊断性乳腺影像学检查结果经常提示需获得确切的组织学诊断。
- 放射科医生负责解读影像，确定是否需要并实施活检。
- 放射科医生负责接收病理结果，确定组织诊断与影像学结果的一致性，并引导患者接受最合适的治疗。
- 放射科医师亦具独特优势，以温和而巧妙的乐观态度提升患者对病理结果的理解和接纳程度。
- 与患者沟通，解释乳腺诊断影像学检查的获益、风险和基本技术要点。
- 就乳腺 X 线摄影检查的获益和风险与患者沟通。
- 能够在医学研究结束时，根据影像学报告，在监督下（必要时）向患者及其家属传达乳腺影像学检查的结果。
- 能够依据临床情境，正确建议最合适的影像学检查。

Multidisciplinary Team Meeting

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

多学科团队会议

/ Considerations in Communicating with Health Professionals

Standardisation of breast imaging report classification facilitates clear communication between referrer and the radiologist regarding the likelihood of malignant findings and the need for further investigation.

>-< FURTHER KNOWLEDGE

Comparison of Imaging Classification Systems

CATEGORY	BI-RADS	EUROPEAN/ROYAL COLLEGE OF RADIOLOGISTS BREAST GROUP
0	Incomplete assessment *Need to review priors and/or complete additional imaging*	
1	Negative	Normal/no significant abnormality
2	Benign finding	Benign finding
3	Probably benign findings (< 2% risk of malignancy). *Short-term follow-up review at 6 months, then every 6-12 months for 1-2 years)*	Indeterminate/probably benign findings. *There is a small risk of malignancy. Further investigation is indicated.*
4	Suspicious abnormality – biopsy recommended	Findings suspicious of malignancy There is a moderate risk of malignancy
5	Malignant findings	Findings highly suspicious of malignancy
6	Known biopsy-proven malignancy, treatment pending.	

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 与卫生专业人员沟通的注意事项

乳腺影像学检查报告分类标准化有助于转诊医生与放射科医生就恶性发现的可能性和进一步检查的必要性进行明确沟通。

>-< 进阶知识

影像学检查分类系统的比较

类别	BI-RADS	欧洲/英国皇家放射科医师学院乳腺组
0	评估不完全 *需要审查既往史和/或完成其他影像学检查*	
1	阴性	正常/无明显异常
2	良性发现	良性发现
3	可能为良性的发现（恶性肿瘤风险 < 2%）。 *（6 个月时进行短期随访复查，之后每 6～12 个月随访一次，持续 1～2 年）*	不确定/可能为良性的发现。 *有较低风险为恶性。需要进一步检查。*
4	可疑异常 - 建议活检	疑似恶性的发现 有中度风险为恶性。
5	恶性发现	高度疑似恶性的发现
6	已知活检证实为恶性，等待治疗。	

/ Breast Imaging

/ 乳腺影像学

NIH

NCI Dictionary of Cancer Terms: “Treatment planning approach in which a number of doctors who are experts in different specialties (disciplines) review and discuss the medical condition and treatment options of a patient” .

Values that underlie an effective multidisciplinary team include:

/ effective communication and coordination

/ respect and trust

/ solid implementation strategies

/ transparency

NCI 癌症术语词典：“一种治疗规划方式，由多位来自不同专科（学科）的医生专家共同审查并讨论患者医疗状况及治疗方案。”

高效的多学科团队应具有以下特质：

/ 有效沟通和协调

/ 相互尊重信任

/ 可靠的实施策略

/ 透明度

/ Multidisciplinary Team Meeting

<!> ATTENTION

All breast cancer specialists will attend the Multidisciplinary Team Meeting (MTM) on a regular basis in order to provide excellent breast cancer care: (oncoplastic) surgeon, medical oncologist, radiation oncologist, pathologist, radiologist and nuclear medicine physician.

The role for the radiologist at MTM is to demonstrate and explain imaging findings per patient, in order to facilitate a proper treatment plan in consensus with the other specialists.

If the management is agreed at MTM, treatment plan can be discussed with the patient.

In the case of discordant findings, repeat imaging with or without biopsy can be considered.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 多学科团队会议

<!> 注意

所有乳腺癌专家将定期参加多学科团队会议（Multidisciplinary Team Meeting，MTM），制定出色的乳腺癌治疗方案：（肿瘤整形）外科医生、肿瘤内科医生、放射肿瘤科医生、病理科医生、放射科医生和核医学医生。

放射科医生在 MTM 中的作用是展示和解释每例患者的影像学检查结果，以便与其他专家达成共识，制定适当的治疗计划。

如果 MTM 达成一致的管理方案，则可以与患者讨论治疗计划。

若有不一致的发现，可考虑重复影像学检查（联合或不联合活检）。

/ Take-Home Messages

<!> ATTENTION

- Imaging is used as part of **triple assessment** to diagnose and exclude disease.
- **Mammography** is the cornerstone of breast imaging, playing a crucial role as the screening imaging technique in women with average-risk of developing breast cancer.
- **DBT** is a mammography-based imaging technique that produces quasi-3D images of the breast, reducing the limitations of 2D imaging (overlapping tissues) and improving the detection and the delineation of findings, increasing the sensitivity and the specificity.
- **CEM** is a relatively new mammography-based imaging technique that relies on the intravenous administration of an iodinated contrast agent to highlight areas of increased contrast agent uptake; currently it can be considered as an alternative for women with contraindications to breast MRI.
- **Breast US** is a dynamic non-ionising, accessible and cheap imaging technique that plays a very important role in the everyday practice by providing additional screening in women with dense breasts, by allowing direct real-time correlation of imaging and clinical findings and by guiding biopsies and other interventional procedure.
- **Breast MRI** is a multiparametric imaging technique that has changed Breast Imaging, playing a very important role in different scenarios, such as in breast cancer staging, in the evaluation of response to neoadjuvant therapy and in the screening of women with high-risk of developing breast cancer and in women with extremely dense breasts.
- **Image guided biopsy** for diagnosis are used extensively; minimally invasive treatment becoming more popular in good prognosis disease such as DCIS and **low grade cancer.**

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 核心要点

<!> 注意

- 影像学检查作为三联评估的一部分，用于诊断和排除疾病。
- 乳腺 X 线摄影是乳腺影像学检查的基石，在中等风险女性乳腺癌的影像学筛查技术中发挥着至关重要的作用。
- DBT 是一种基于乳腺 X 线摄影的影像学技术，可生成乳腺的拟 3D 影像，减少 2D 影像学检查的局限性（重叠组织），并改善检测和描绘影像学发现的效果，提高敏感性和特异性。
- CEM 是一种相对较新的影像学技术，它基于乳腺 X 线摄影，依赖静脉注射碘化对比剂来突显对比剂摄取增加的区域；目前它可作为对乳腺 MRI 有禁忌证的女性的替代检查方案。
- 乳腺 US 是一种动态、非电离、可及性好且成本低的影像学技术，它可以作为针对乳腺组织致密的女性的辅助筛查手段，可直接将影像学检查和临床发现进行实时关联，还能指导活检和其他介入手术，在日常实践中发挥着非常重要的作用。
- 乳腺 MRI 是一种革新了乳腺影像学检查的多参数影像学技术，在不同场景中发挥着非常重要的作用，例如乳腺癌分期、新辅助治疗疗效评估、乳腺癌高风险女性和乳腺组织极度致密女性的筛查。
- 影像引导下活检在诊断方面的应用非常广泛；微创治疗在预后良好的疾病（例如 DCIS 和低级别癌症）中越来越普遍。

Breast Imaging

乳腺影像学

CHAPTER OUTLINE:

章节大纲：

<!> ATTENTION

- Knowledge of the anatomy, anatomical variants and changes during pregnancy and lactation is important to recognise disease.
- Imaging findings should be evaluated together with signs and symptoms. They should be compared with previous examinations.
- **Mammography** is the first-line imaging tool for patients over 40 years of age. Targeted ultrasound can be done in the presence of suspicious findings or if the patient has an extremely dense breast.
- **Ultrasound** is the first-line imaging tool for patients under 40 years of age.
- **Benign diseases** of the breast, especially cysts and fibroadenomas are the most common and symptomatic masses in women.
- **Contrast-enhanced MRI** is a problem-solving tool with the highest sensitivity and negative predictive value for breast cancer detection.
- Some high-grade aggressive tumours (medullary type, grade 3 or triple-negative type etc.) can mimic benign masses on mammography/ultrasound. In patients with a family history, attention should be paid to newly developing lesions or masses showing increased size during follow-up. These masses should be confirmed by biopsy.
- Imaging the axilla to determine if there any abnormal lymph nodes is part of preoperative staging
- Clear communication of results with a management plan is part of the role of the radiologist.

<!> 注意

- 了解妊娠期和哺乳期的解剖结构、解剖学变异和变化对于识别疾病非常重要。
- 影像学检查中的发现应与体征和症状一起评估。应与之前的检查进行比较。
- **乳腺 X 线摄影**是适用于 40 岁以上患者的一线影像学检查工具。有可疑发现或患者乳腺极度致密时，可进行靶向超声检查。
- **超声检查**是适用于 40 岁以下患者的一线影像学检查工具。
- 乳腺**良性疾病**（尤其是囊肿和纤维腺瘤）是女性最常见且有症状的肿块。
- **对比增强 MRI** 是一种用于乳腺癌检测的问题解决工具，它的敏感度和阴性预测值最高。
- 一些高级别侵袭性肿瘤（髓质型、3 级或三阴型等）在乳腺 X 线摄影/超声检查中可能类似良性肿块。对于有家族史的患者，在随访期间应留意新发病灶或体积增大的肿块。这些肿块应通过活检确诊。
- 对患者腋窝进行影像学检查以确定是否有异常淋巴结是术前分期的一部分
- 放射科医生有责任就检查结果和治疗计划与患者进行明确沟通。

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Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

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CHAPTER OUTLINE:

乳腺影像学

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- Sardanelli F, Fallenberg EM, Clauser P, Trimboli R, Camps-Herrero J, Helbich TH, Forrai G. Mammography: an update of the EUSOBI recommendations on information for women. https://www.eusobi.org/breast-imaging-publications-and-guidelines/
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High Risk Women

- Monticciolo DL, Newell MS, Moy L, Niell B, Monsees B, Sickles EA. Breast Cancer Screening in Women at Higher-Than-Average Risk: Recommendations From the ACR. J Am Coll Radiol. 2018 Mar;15(3 Pt A):408-414. doi: 10.1016/j.jacr.2017.11.034.
- Sardanelli F et al. Position paper on screening for breast cancer by the European Society of Breast Imaging (EUSOBI) and 30 national breast radiology bodies from Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Israel, Lithuania, Moldova, The Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Spain, Sweden, Switzerland and Turkey. Eur Radiol. 2017 Jul;27(7):2737-2743. doi: 10.1007/s00330-016-4612-z.
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Communication

- IDoR Publication 2016 SCREENING & BEYOND Medical imaging in the Detection, Diagnosis and Management of Breast Diseases https://www.internationaldayofradiology.com/app/uploads/2017/09/IDoR-2016_Book-on-Breast-Imaging_Web_low.pdf
- Sardanelli F, Fallenberg EM, Clauser P, Trimboli R, Camps-Herrero J, Helbich TH, Forrai G. Mammography: an update of the EUSOBI recommendations on information for women. https://www.eusobi.org/breast-imaging-publications-and-guidelines/
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Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

高风险女性

- Monticciolo DL, Newell MS, Moy L, Niell B, Monsees B, Sickles EA. Breast Cancer Screening in Women at Higher-Than-Average Risk: Recommendations From the ACR. J Am Coll Radiol. 2018 Mar;15(3 Pt A):408-414. doi: 10.1016/j.jacr.2017.11.034.
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- Thomas PS. Diagnosis and Management of High-Risk Breast Lesions. J Natl Compr Canc Netw. 2018 Nov;16(11):1391-1396. doi: 10.6004/jnccn.2018.7099.
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沟通

- IDoR Publication 2016 SCREENING & BEYOND Medical imaging in the Detection, Diagnosis and Management of Breast Diseases https://www.internationaldayofradiology.com/app/uploads/2017/09/IDoR-2016_Book-on-Breast-Imaging_Web_low.pdf
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- Maxwell AJ, Ridley NT, Rubin G, Wallis MG, Gilbert FJ and Michell M The Royal College of Radiologists Breast Group breast imaging classification. Clinical Radiology, 64, 2009, Pages 624-627

Test Your Knowledge

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

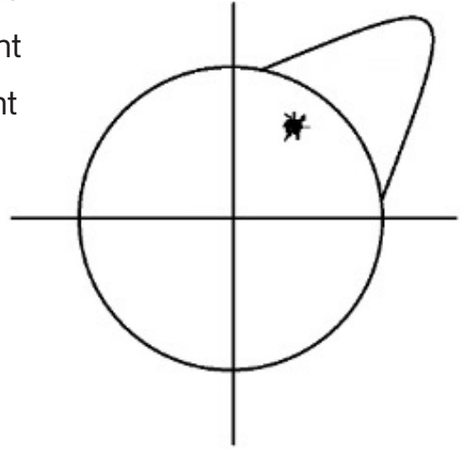
知识测试

/ Test Your Knowledge

<?> QUESTION

1 How would you describe the location of the lesion?

- ☐ Upper outer quadrant
- ☐ Upper inner quadrant
- ☐ Lower outer quadrant
- ☐ Lower inner quadrant



CHAPTER OUTLINE:

章节大纲：

/ 知识测试

<?> 问题

1 您如何描述病灶位置？

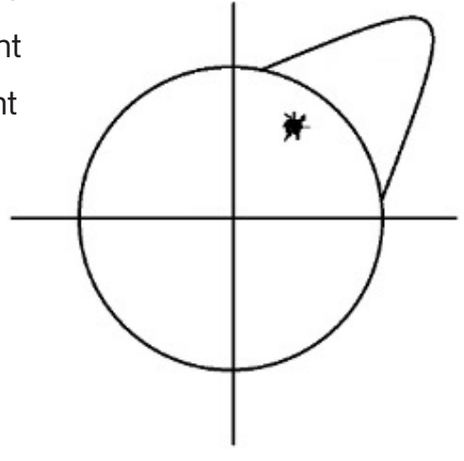
- ☐ 外上象限
- ☐ 内上象限
- ☐ 外下象限
- ☐ 内下象限

/ Test Your Knowledge

<?> ANSWER

1 How would you describe the location of the lesion?

- [x] Upper outer quadrant
- [ ] Upper inner quadrant
- [ ] Lower outer quadrant
- [ ] Lower inner quadrant



CHAPTER OUTLINE:

章节大纲：

/ 知识测试

<?> 回答

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- [x] 外上象限
- [ ] 内上象限
- [ ] 外下象限
- [ ] 内下象限

/ Test Your Knowledge

<?> QUESTION

2 What is the name of the syndrome consisting of unilateral partial or complete absence of the m. pectoralis, with associated breast hypo/aplasia and possible rib/chest wall deformities?

- ☐ Holland syndrome
- ☐ Poland syndrome
- ☐ Germany syndrome
- ☐ Switzerland syndrome

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

2 该综合征的名称是什么？其特征为：单侧胸大肌部分或完全缺如，伴乳房发育不良/发育不全，并可能伴有肋骨/胸壁畸形。

- ☐ Holland 综合征
- ☐ Poland 综合征
- ☐ Germany 综合征
- ☐ Switzerland 综合征

/ Test Your Knowledge

<?> ANSWER

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/ 知识测试

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- ☐ Holland 综合征
- ■ Poland 综合征
- ☐ Germany 综合征
- ☐ Switzerland 综合征

/ Test Your Knowledge

<?> QUESTION

3 Pregnancy and Lactation: What are the most seen ultrasound findings in a lactating breast?

- ☐ Decreased parenchymal echogeniety and cysts
- ☐ Decreased parenchymal echogeniety and dilated ducts
- ☐ Increased parenchymal echogeniety and cysts
- ☐ Increased parenchymal echogeniety and dilated ducts

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

3 妊娠期和哺乳期：哺乳期乳房最常见的超声表现是什么？

- ☐ 实质回声减弱和囊肿
- ☐ 实质回声减弱和导管扩张
- ☐ 实质回声增强和囊肿
- ☐ 实质回声增强和导管扩张

/ Test Your Knowledge

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/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

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- ■ 实质回声增强和导管扩张

/ Test Your Knowledge

<?> QUESTION

4 Regarding Breast Ultrasound (US), select the TRUE statement:

- ☐ Breast US is an imaging technique that exploits the magnetism of the protons that constitute the breast (and surrounding) tissues to create diagnostic images.
- ☐ The American College of Radiology (ACR) recommends performing Breast US using low-frequency transducers, with a broad bandwidth operating at a centre frequency of no more than 5 MHz.
- ☐ Elastography is a modality of Breast US that allows the evaluation of stiffness.
- ☐ One of the main advantages of Breast US is that it is an “operator-independent” imaging technique.
- ☐ Breast US is contraindicated in the evaluation of symptomatic young or lactating patients.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

4 请从以下关于 US 的表述中选择正确的选项：

- ☐ 乳腺 US 是利用构成乳腺（及其周围）组织的质子磁性生成诊断图像的成像技术。
- ☐ ACR 推荐使用带宽较宽且中心频率不超过 5 MHz 的低频探头进行乳腺 US。
- ☐ 弹性成像是一种可以评价硬度的乳腺 US 检查模式。
- ☐ 乳腺 US 是一种不依赖于操作者的影像学技术，这是它的主要优点之一。
- ☐ 乳腺 US 禁止用于评估有症状的年轻或哺乳期患者。

/ Test Your Knowledge

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/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺 影像学

章节大纲：

/ 知识测试

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- ☐ 乳腺 US 禁止用于评估有症状的年轻或哺乳期患者。

/ Test Your Knowledge

<?> QUESTION

5 Which of the following characteristic does NOT indicate a malignancy on ultrasound?

- ☐ Irregular shape
- ☐ Shadowing
- ☐ Parallel orientation
- ☐ Not-circumscribed margins

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

5 下列哪一项特征在超声检查中并非提示恶性肿瘤？

- ☐ 形状不规则
- ☐ 阴影
- ☐ 平行走向
- ☐ 切缘不清晰

/ Test Your Knowledge

<?> ANSWER

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/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

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/ Test Your Knowledge

<?> QUESTION

6 Which of these is a main advantage of breast Magnetic Resonance?

- ☐ High soft-tissue contrast
- ☐ Costs
- ☐ Scanning times
- ☐ Use in claustrophobic patients

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

6 以下哪些是乳腺磁共振的主要优势？

- ☐ 软组织对比度高
- ☐ 成本
- ☐ 扫描时间
- ☐ 适用于幽闭恐怖症患者

/ Test Your Knowledge

<?> ANSWER

6 Which of these is a main advantage of breast Magnetic Resonance?

- [x] High soft-tissue contrast
- [ ] Costs
- [ ] Scanning times
- [ ] Use in claustrophobic patients

CHAPTER OUTLINE:

章节大纲：

/ 知识测试

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- [ ] 成本
- [ ] 扫描时间
- [ ] 适用于幽闭恐怖症患者

/ Test Your Knowledge

<?> QUESTION

7

Regarding Breast Magnetic Resonance Imaging (MRI) and Contrast-enhanced Mammography (CEM), select the FALSE statement:

- ☐ Breast MRI is an imaging technique that uses sound waves to visualise breast tissue.
- ☐ Comparing to other imaging techniques, Breast MRI produces images with superior soft-tissue contrast.
- ☐ Breast MRI is useful in the evaluation of breast implants.
- ☐ CEM is an imaging technique based on dual-energy mammographic acquisition after intravenous administration of an iodinated contrast agent.
- ☐ The Field of View (FoV) of CEM is limited comparing to that of Breast MRI.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

7

关于乳腺 MRI 和对比增强乳腺 X 线摄影 (CEM)，请选择错误陈述：

- ☐ 乳腺 MRI 是一种利用声波来可视化乳腺组织的影像学技术。
- ☐ 与其他影像学技术相比，乳腺 MRI 生成的影像的软组织对比度更高。
- ☐ 乳腺 MRI 可用于评估乳房植入物。
- ☐ CEM 是一种静脉注射碘化对比剂后基于双能乳腺 X 线摄影采集影像的影像学技术。
- ☐ 与乳腺 MRI 相比，CEM 的视野 (FoV) 有限。

/ Test Your Knowledge

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CHAPTER OUTLINE:

/ 知识测试

章节大纲：

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- ☐ 与乳腺 MRI 相比，CEM 的视野 (FoV) 有限。

/ Test Your Knowledge

<?> QUESTION

8 What should a breast imaging report contain?

- ☐ Clinical information and indication
- ☐ Breast density - Tissue composition-enhancement pattern
- ☐ Assessment category
- ☐ Recommendations
- ☐ All

CHAPTER OUTLINE:

章节大纲：

/ 知识测试

<?> 问题

8 乳腺影像学检查报告应当包括哪些内容？

- ☐ 临床信息和适应证
- ☐ 乳腺密度 - 组织组成 - 增强模式
- ☐ 评估类别
- ☐ 建议
- ☐ 以上全部

/ Test Your Knowledge

<?> ANSWER

8 What should a breast imaging report contain?

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- ☐ Breast density - Tissue composition-enhancement pattern
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/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

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- ☐ 建议
- ■ 以上全部

/ Test Your Knowledge

<?> QUESTION

9 Which of the following is included in the Triple Assessment of a suspicious breast lesion?

- ☐ Surgery
- ☐ Radiotheraphy
- ☐ Clinical examination
- ☐ Family history

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

9 可疑乳房病变的三联评估包含以下哪些项目？

- ☐ 手术
- ☐ 放疗
- ☐ 临床检查
- ☐ 家族史

/ Test Your Knowledge

<?> ANSWER

9 Which of the following is included in the Triple Assessment of a suspicious breast lesion?

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/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

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/ 知识测试

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- ■ 临床检查
- ☐ 家族史

/ Test Your Knowledge

<?> QUESTION

10 What is the best imaging modality to depict cysts?

- ☐ Mammography
- ☐ Ultrasound
- ☐ MR
- ☐ CT

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

10 显示囊肿的理想影像学检查手段是什么？

- ☐ 乳腺 X 线摄影
- ☐ 超声检查
- ☐ MR
- ☐ CT

/ Test Your Knowledge

<?> ANSWER

10 What is the best imaging modality to depict cysts?

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/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

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- ■ 超声检查
- ☐ MR
- ☐ CT

/ Test Your Knowledge

<?> QUESTION

11

Fibroadenoma:

- ☐ is a malignant breast disease.
- ☐ is the most common solid mass in woman of all ages.
- ☐ necessitates biopsy if its diameter increases by more than 20 percent within 6 months.
- ☐ presents as a firm mass adherent to the surrounding tissue.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

11

纤维腺瘤：

- ☐ 是一种恶性乳房疾病。
- ☐ 是所有年龄段女性中最常见的实性肿块。
- ☐ 如果 6 个月内直径增加超过 20%，则有必要进行活检。
- ☐ 表现为与周围组织粘连的硬块。

/ Test Your Knowledge

<?> ANSWER

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/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

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- ☐ 表现为与周围组织粘连的硬块。

/ Test Your Knowledge

<?> QUESTION

12 Regarding Hamartoma, select the FALSE statement:

- ☐ can present as vague breast mass.
- ☐ contains integral epithelial and stromal components.
- ☐ can enlarge.
- ☐ needs core biopsy.

/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 问题

12 关于错构瘤，请选择错误的陈述：

- ☐ 可表现为模糊的乳房硬块。
- ☐ 包含完整的上皮和间质成分。
- ☐ 可以增大。
- ☐ 需要进行粗针穿刺活检。

/ Test Your Knowledge

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/ Breast Imaging

CHAPTER OUTLINE:

/ 乳腺影像学

章节大纲：

/ 知识测试

<?> 回答

12 关于错构瘤，请选择错误的陈述：

- ☐ 可表现为模糊的乳房硬块。
- ☐ 包含完整的上皮和间质成分。
- ☐ 可以增大。
- ■ 需要进行粗针穿刺活检。

Test Your Knowledge

<?> QUESTION

13 Select the predisposing conditions for fat necrosis.

- ☐ Blunt trauma
- ☐ Surgery
- ☐ Spontaneous in diabetic patients
- ☐ Lipoma

Breast Imaging

CHAPTER OUTLINE:

乳腺影像学

章节大纲：

知识测试

<?> 问题

13 请选择脂肪坏死的诱发条件。

- ☐ 钝性损伤
- ☐ 手术
- ☐ 糖尿病患者的自发性症状
- ☐ 脂肪瘤

/ Test Your Knowledge

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/ Test Your Knowledge

<?> QUESTION

14 Which of the following minimal invasive treatments does NOT use electromagnetic waves to achieve local tumour ablation?

- ☐ Radiofrequency
- ☐ Microwaves
- ☐ Laser ablation
- ☐ Cryoablation

CHAPTER OUTLINE:

章节大纲：

/ 知识测试

<?> 问题

14 以下哪种微创治疗不使用电磁波实现肿瘤局部消融？

- ☐ 射频
- ☐ 微波
- ☐ 激光消融术
- ☐ 冷冻消融术

/ Test Your Knowledge

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/ Test Your Knowledge

<?> QUESTION

15 Which of these factors is associated with an increased risk of breast cancer?

- ☐ Early menarche
- ☐ Late first pregnancy (after age 28 years)
- ☐ Nulliparity
- ☐ Late menopause
- ☐ All

/ Breast Imaging

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/ 乳腺影像学

章节大纲：

<?> 问题

15 以下哪些因素与乳腺癌风险增加相关？

- ☐ 月经初潮提前
- ☐ 首次妊娠时间较晚（28 岁以后）
- ☐ 未产妇
- ☐ 绝经期较晚
- ☐ 以上全部

/ Test Your Knowledge

<?> ANSWER

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/ 乳腺影像学

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- ■ 以上全部

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