Food for thought - a pictorial exhibit of radiological food-related signs

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Learning objectives

1. To demonstrate the commonly and infrequently encountered radiological food-related signs in everyday practice.
2. This pictorial exhibit will serve as a fun and ‘palatable’ educational tool for fellow radiology trainees and general radiologists.
Background

For those with a creative mind, the radiological appearances of various pathological conditions can be likened to fruit, vegetables and other foods, lending them characteristic, and at times pathognomonic, radiologic manifestations. These “food signs” are highly memorable and easily recognizable.

Being a visual and technical specialty, pattern recognition and an observant eye for spotting subtle differences is essential for interpretation and successful diagnosis.
Findings and procedure details

Our poster depicts a variety of radiological food-related signs, described in a case-based format. All the images demonstrated in this poster have been locally sourced - bon appetit!

**Case 1:** The first case regards a 42 year old female, known case of serous ovarian adenocarcinoma who underwent pelvic surgery and had six cycles of chemotherapy, and is currently on monoclonal antibody therapy (bevacizumab).

Figure 1 is an axial image through the upper abdomen, taken from a follow-up post-operative Computed Tomography (CT) scan. It shows diffuse-pattern peritoneal metastatic disease (peritoneal caking). Low attenuating areas of soft tissue density can be seen enveloping or distributed throughout the abdominal slices and are outlined in pink in the aforementedioned CT images.

Figure 2 is an axial image at the level of the pelvic inlet of a different patient, who, similarly to the above described case, has ovarian adenocarcinoma with peritoneal disease. However, in comparison to the case above, the peritoneal involvement is focal rather than diffuse. The focal area of peritoneal caking is outlined in pink.

**Explanation of the sign:** For those with a sweet tooth, the omental cake refers to the appearances of the omental mass simulating the icing on a cake. The underlying process is that of infiltration of the omental fat by material of soft-tissue density. It can often be associated with malignant ascites or peritoneal deposits. The most common cause is metastases from ovarian, gastric or colon cancer. Other causes include TB peritonitis and lymphoma. [1], [2]

**Case 2:** 50 year old female patient with long-standing, bilateral breast implants. She presented with symptoms suggestive of rupture/displacement of the implants. She had had mammography one year prior which had showed displacement but no rupture at that time.

Figure 3 is an axial T2-weighted magnetic resonance (MR) image. On this image one can appreciate the asymmetrical appearances of the breast implants, the left appearing smaller than the right. Bilateral linguine sign is present, more extensive on the right. This is highlighted in yellow. Appearances are indicative of bilateral intra-capsular implant ruptures with a small amount of right extra-capsular leak.
**Explanation of the sign:** The linguine sign is one of the imaging signs of intra-capsular rupture of a breast implant.

In an intra-capsular rupture, the shell form becomes disorganised and appears as wavy lines - the contents of the implant are contained by the fibrous scar, formed around the shell following implantation of saline or silicone implants. This term is commonly described on MRI but can also be seen on CT modality. [3], [4]

**Case 3:** 30 year old female who presented with severe lower abdominal pain and rebound tenderness in the right iliac fossa region.

In a typical case presentation such as this one described, the right iliac fossa is examined using a high frequency linear probe and a graded compression technique. In figure 4 it can be seen that there are multiple circular hypoechoic focal areas arising from the right adnexa, representing endometriotic deposits. These are simple cysts with a thin wall and no intra-lesional septations. They are highlighted in brown on the ultrasound image.

**Explanation of the sign:** Occurring in women of reproductive age, endometriomas, also known as chocolate cysts or endometriotic cysts, are readily diagnosed on ultrasound, with most demonstrating classical radiographic features.

Endometriomas contains dark degenerated blood products following repeated cyclical haemorrhage. They average at 2-5cm in size but can be up to 20cm. 75% will typically be located in the ovaries. Around 10% can be found in the uterus and even 5% in the colon.

The appearances of endometriomas can be quite variable. Classically they appear as a unilocular cyst which is hypoechoic with diffuse homogeneous ground-glass echoes as a result of the haemorrhagic debris. This appearance occurs in 50% of cases. Less common features that may be seen are that of multiloculation, hyperchoic wall foci, solid components or wholly solid, and anechoic cysts (rare finding). [5], [6], [7]

**Case 4 (a):** 74 year old female with fractured right neck of femur. A chest x-ray was performed for pre-operative assessment.
In the periphery of the film, on the right, is an area of irregularly-shaped but well-defined foci of coarse calcification - projected in figure 5. This focus of popcorn calcification in the projection of the right breast is indicative of an involuted fibroadenoma. Further evaluation by elective mammography was suggested in this case.

**Case 5:** 81 year old female with signs and symptoms of finger clubbing, peripheral cyanosis and exertional dyspnoea.

The axial high-resolution CT (HRCT) image in figure 9, portrays extensive subpleural honeycombing - bullous, cystic change beneath the pleura of the upper lobes. In this case, the air spaces are also enlarged. There is traction bronchiectasis (abnormal dilatation of the bronchioles) and resulting distortion of the parenchyma especially in the lung bases. The described findings are representative of pulmonary fibrosis with honeycomb changes in keeping with established fibrosis of UIP pattern. This predictive sign that adds diagnostic confidence and precludes the need for a lung biopsy. The honeycombing pattern described is highlighted in yellow on the image.

**Explanation of the sign:** Honeycombing refers to the CT appearance of pulmonary fibrosis or interstitial lung disease. Criteria include as a collection of cystic air spaces between 3-10mm in diameter but occasionally as large as 2.5cm. There is discrete delineation with thick fibrous wall and are often subpleural and basal in distribution. It is associated with chronic irreversible disease state with poor prognostic outcomes. The other main differential diagnosis would be emphysema. [11], [12], [13]
**Case 6:** 46 year old female, with a long-term smoking history, who presented with occasional dyspnoea. Clinical auscultation of the chest reveals harsh breath sounds.

Figure 10 depicts multiple tiny calcified opacities with a widespread distribution seen bilaterally on this postero-anterior chest radiograph. Bilateral and symmetrical miliary calcified opacities are highly suggestive of varicella pneumonia.

**Explanation of the sign:** Miliary opacities are the numerous, small 1-4 mm pulmonary nodules disseminated throughout the lungs. These are likened to millet seeds. This sign is usually identified on plain films but can also be appreciated on cross sectional imaging. An important classification would be febrile and afebrile subtypes. Common causes are infection e.g. TB, varicella; metastatic disease from thyroid, renal cell, breast, melanoma, osteosarcoma; and interstitial lung disease e.g. sarcoidosis and silicosis. [14], [15]

**Case 7:** 67 year old male presenting with dyspnoea.

Figure 11 shows multiple cystic looking areas in the left lower lung zone. These appear to be closely approximated dilated bronchioles; findings are in keeping with cystic bronchiectasis.

**Explanation of the sign:** Bunch-of-grapes sign refers to the radiological appearance in bronchiectasis where multiple dilated bronchi in close proximity to each other appear as a bunch-of-grapes on plain film.

This sign can also be used to describe multiple cystic spaces within the uterus as the result of hydromic swelling of trophoblastic villi within a hydatidiform mole or the appearances of an intraductal papillary mucinous neoplasm. [16], [17], [18]

**Case 8:** 82 year old female presented with nausea, severe abdominal distension, and not passing flatus.

In figure 12 there is a grossly distended loop of bowel which appears to arise from the pelvis. It has a sharp kink in the projection of the right upper quadrant. The bowel proximal to the twisted loop is not dilated. The distal rectum appears empty. Abdominal radiograph findings are indicative of sigmoid volvulus.
**Explanation of the sign:** The coffee-bean sign is seen on abdominal x-ray signifying a sigmoid volvulus. The section of colon proximal to the site of the volvulus is dilated. The inner wall is thicker because of the opposition of two loops of bowel. The loop of bowel takes on a 'u' shaped form and should point to the right upper quadrant unlike in caecal volvulus where the point should be directed to the left upper quadrant. The afferent and efferent end should point to the left lower quadrant. The colon will lose its definition of the haustra due to the pressure from the distension.

Further cross-sectional imaging is often performed which shows classical signs of obstruction - distended bowel loops with a fluid level. Cross-sectional imaging is also imperative in such cases to assess for any ensuing ischaemia. [19], [20], [21], [22]

**Case 9:** 74 year old female with T11-T12 fracture who presents with bilateral lower limb pain and paresthesia. MRI spine was ordered to assess for cord compression from the fracture.

The MRI image depicted in figure 13 shows low intensity signalling of the T12 vertebrae. There is loss of height across its antero-posterior plane suggestive of a crush fracture. There is bulging of the disc posteriorly which is causing impingement on the conus medullaris. Osteodegenerative change is noted throughout the thoracolumbar spine.

The pancake vertebra sign is depicted by the crush fracture of T12 with posterior displacement and the symmetrical collapse of the T11 upper endplate with no signs of displacement.

**Explanation of the sign:** Vertebra plana or pancake vertebra refers to the situation where a vertebral body has lost almost its entire height, anteriorly and posteriorly - it is a sign of very advanced crush fracture. It is most clearly seen on MR imaging. It can occur with a wide range of settings, including trauma, osteoporosis, vertebral metastases, osteomyelitis, lymphoma, multiple myeloma. In paediatric cases, the most common causes are leukaemia and Langerhans cell histiocytosis. [23]

**Case 10: (a)** 69 year old male being assessed for dysphagia. Upper gastro-intestinal contrast-enhanced fluoroscopic images in figure 14 demonstrate a malignant irregular-shaped stricture of the distal oesophageal sphincter with shouldering.
(b) 57 year old female found to have a rectal carcinoma, needs staging prior to surgery/neoadjuvant therapy. A similar apple-core configuration can be seen on the coronally-reformatted MR image in figure 15. There is a cut-out pattern bilaterally at the level of the rectum - this signifies the presence of a rectal tumour.

**Explanation of the sign:** The apple core sign is typically seen in cases of colorectal cancer which is annular in form. This kind of tumour produces abnormal thickening of the colon wall. It is very common to find associated obstruction. Two modalities that best illustrate this are fluoroscopy CT and MRI. Differentials for this appearance include Crohn's disease, Ulcerative colitis, ischaemic colitis; infections including chlamydia and TB.

Radiation-treated colonic malignancies may also have similar radiologic features. [24], [25]

**Case 11:** Follow-up MRI scan of a 60 year old male.

This patient is known to have bilateral aneurysms of the cavernous portion of the internal carotid arteries (ICAs). This location is rare in incidence. Both were treated in the past with coiling. On this T2-weighted axial MRI sequence (figure 16), the left-sided saccular aneurysm, which is hypointense on T2, shows interval growth whilst the right-sided aneurysm has remained stable in size. The corresponding MR angiogram (figure 17) very distinctly shows the left-sided saccular ICA aneurysm.

See figures 16 and 17; the ICA saccular berry-shaped aneurysms are highlighted in blue and violet, respectively.

**Explanation of the sign:** Berry aneurysms, also known as saccular cerebral aneurysms, is the name given to intracranial aneurysms with a characteristic rounded or sack-like shape up to 25mm in size and accounting for the majority of intracranial aneurysms.

They are also the most common cause of subarachnoid haemorrhage which is not traumatic in nature.

Prevalence of berry aneurysms is thought to be between 0.2-8.9% of the general population. 15-30% can have multiple found on angiography. Family history is noted to be a factor at a 30% increase risk with a first degree relative being affected.
The outpouchings arise at weak point in vessels i.e. the bifurcations where the arterial wall is subjected to turbulence. In reaction to this the hyaline in the intima is greatly increased but it is weakened at this expense. Approximately 90% arise from the anterior circulation at the anterior cerebral artery, anterior communicating artery and the middle cerebral artery (approximately 30% each).

It may be associated with connective tissue disorders and congenital abnormalities: examples include Marfan's disease, autosomal dominant polycystic kidneys, Neurofibromatosis type 1, cerebral AV malformations, coarctation of the aorta and alpha1 antitrypsin deficiency to name a few. [26], [27], [28], [29]

Case 12: 33 year old male with known Ollier's disease. A bilateral hand x ray was performed.

Figure 18 is the x-ray of the right hand and shows multiple enchondromata are noted within the right hand at the following sites: diaphysis of the proximal phalanx of the middle finger, the proximal and middle phalanx of the ring finger, the distal diaphysis of the fourth metacarpal, the proximal diaphysis of the proximal phalanx of the little finger and the distal diaphysis of the fifth metacarpal. Some of the lesions are outlined in the image in orange.

Explanation of the sign: Endosteal scalloping describes the radiological finding on multiple modalities of focal resorption of the inner margin of cortical bones at the margin of cortex and medulla. It is typically seen in long bones, but also in the vertebrae and is due to slow growing medullary lesions that may be benign or malignant in nature so slow-growth does not necessarily imply that the lesion is benign. The pattern is of punched out regions that are more lucent compared to the adjacent cortex.

There are a number of differential diagnoses giving rise to endosteal scalloping. Benign lesions that give this pattern include enchondroma, chondromyxoid fibroma osteomyelitis anaemias. Malignant lesions are usually multiple myeloma, chondrosarcoma and skeletal metastases. [30], [31], [32]

Case 13: 31 year old male patient presenting with lower abdominal pain.
Figure 19 shows a single distended bowel loop to the right of the image which is slightly kinked. The presence of haustra further suggests that the obstruction involves large bowel. Caecal volvulus is suspected. The kidney bean shape is outlined in burgundy.

**Explanation of the sign:** Caecal volvulus describes twisting of the caecum around its mesentery which often results in obstruction. On plain abdominal radiograph, there is a characteristic kidney bean sign that can help diagnose such pathology. It accounts for 10% of the types of volvulus. The modalities on which caecal volvulus can be identified are CT, fluoroscopy as well as abdominal X ray imaging. [33]
Images for this section:

**Fig. 1:** Case 1, peritoneal caking sign, CT axial slice

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**Fig. 2:** Case 1, peritoneal caking sign, CT

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**Fig. 3:** Case 2, linguine sign, MRI

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**Fig. 4:** Case 3, chocolate cyst sign, ultrasound

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Fig. 5: Case 4a, popcorn sign, x-ray

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Fig. 6: Case 4b, popcorn sign, mammogram (white ring is a mole marker)

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Fig. 7: Case 4c, popcorn sign, X ray

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**Fig. 8:** Case 4d, popcorn sign, CT

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**Fig. 9:** Case 5, honeycomb sign, CT

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Fig. 10: Case 6, milliary sign, X ray

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Fig. 11: Case 7, bunch of grapes sign, X ray

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**Fig. 12:** Case 8, coffee bean sign, X ray

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**Fig. 13:** Case 9, pancake vertebra, MRI
**Fig. 14:** Case 10a, apple core sign, Fluoroscopy

**Fig. 15:** Case 10b, apple core sign, MRI T2 weighted
Fig. 16: Case 11, berry sign, MRI

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Fig. 17: Case 11, berry sign, CT angiography

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Fig. 18: Case 12, scalloping sign, X ray

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**Fig. 19:** Case 13, kidney bean sign, X ray

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Conclusion

Some pathologic conditions have classic radiologic manifestations that resemble various types of food. It is important that radiologists recognize these classic signs, which will allow confident diagnosis on the basis of imaging findings alone or narrowing of the differential diagnosis.
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References


NB: all images of food items are sourced from a basic web search which is free to the general public.