Hong Kong J Radiol. 2025;28(4):e276-83. Published 10 December 2025 | https://doi.org/10.12809/hkjr2417910

PICTORIAL ESSAY

Vascular Abnormalities in the Breast: A Pictorial Essay

SH Lee, S Yang, GHC Wong

Department of Radiology and Nuclear Medicine, Tuen Mun Hospital, Hong Kong SAR, China

INTRODUCTION

Vascular lesions are not uncommonly seen in the breast. They can range from benign haemangiomas to aggressive angiosarcomas. Benign lesions and vascular malformations are usually asymptomatic when small in size and may only be incidentally found on imaging. Malignant angiosarcomas are extremely rare and aggressive, often presenting with disseminated metastases on diagnosis. This pictorial essay aims to illustrate the common imaging features of vascular lesions, with the cases identified in the database of a local tertiary hospital in Hong Kong from 2008 to 2024.

BENIGN VASCULAR LESIONS

Haemangioma

Haemangiomas are commonly found in the hepatobiliary and musculoskeletal systems, as well as in the breasts, where they are usually small in size and asymptomatic, usually presenting as an incidental imaging finding. It has been reported that haemangiomas are found in 1.2% of mastectomy specimens and 11% of post-mortem specimens (from a forensic population) of the female breast.[1] Some patients might present with blue skin discolouration when the lesion is large and superficial.

On mammography, haemangiomas are usually equal dense to the breast tissue, and oval in shape with circumscribed or microlobulated margins (Figure 1).[2] Intralesional microcalcifications may be found occasionally[2], which may lead to the need for imaging surveillance or core biopsy.

Sonographically, they are similar to their shape on mammography and are oriented in a parallel manner (Figures 2 and 3).[2] Their echogenicity is variable,[2] and they may exhibit non-specific vascular flow.[3] Overall, there are no definitive imaging features to suggest benignity or malignancy. Histologically, these lesions may present as a proliferation of variably sized, ectatic blood vessels separated by fibrotic stroma.

Management of benign haemangiomas remains controversial due to the sampling error of core biopsy samples and difficulty in clearly delineating the borders of the haemangiomas confidently on core samples. A recent review had explored the possibility of clinical and radiological surveillance in cases of radiologically pathologically concordant haemangiomas, but surgical excision remains the mainstay of management.[4]

Superficial Venous Thrombophlebitis: Mondor's Disease

Mondor's disease is a rare disease characterised by inflammation and thrombosis of the superficial venous

Correspondence: *Dr SH Lee, Department of Radiology and Nuclear Medicine, Tuen Mun Hospital, Hong Kong SAR, China*
Email: lsh689@ha.org.hk

Submitted: 15 October 2024; Accepted: 5 February 2025.

Contributors: SHL designed the study. SHL and GHCW acquired the data. SHL and SY analysed the data. SHL draft the manuscript. SY critically revised the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of Interest: All authors have disclosed no conflicts of interest.

Funding/Support: This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data Availability: All data generated or analysed during the present study are available from the corresponding author on reasonable request.

Ethics Approval: The study was approved by the Central Institutional Review Board of Hospital Authority, Hong Kong (Ref No.: CIRB-2024-186-2). A waiver of patient consent and acknowledgment forms was approved by the Board due to the retrospective nature of the study.

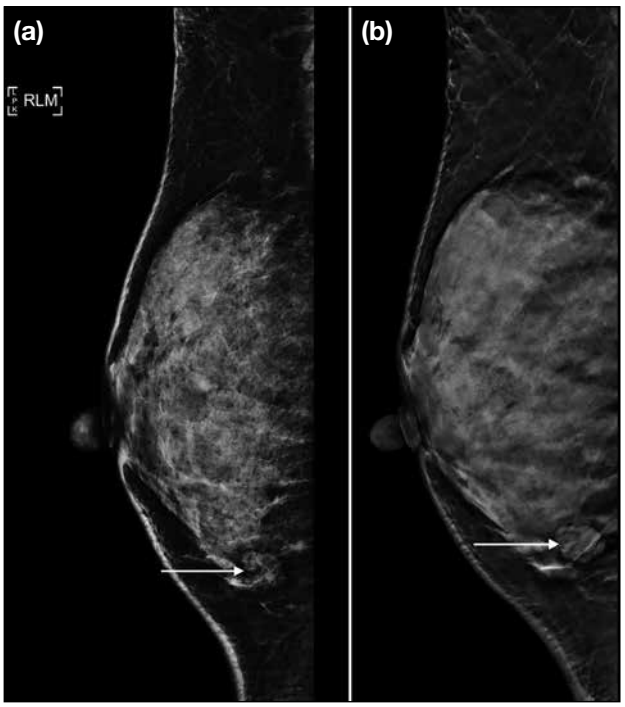

Figure 1. Cavernous haemangioma. (a) Planar mammographic and (b) tomosynthesis images of the right breast (mediolateral view) show a 1.5-cm oval, isodense mass with microlobulated borders in the inferoposterior region, more clearly visualised on tomosynthesis (arrows).

structures in the breast. This disease is found in less than 1% of the population.[5] Clinically, patients present with skin swelling or tender cord-like palpable masses. On mammography, elongated equal density tubular structures are usually found in the upper outer quadrant where the lateral thoracic veins are located (Figure 4).[6] Ultrasound should be performed to exclude underlying breast malignancy since dilated ducts could mimic Mondor's disease mammographically.[6]

On ultrasound, Mondor's disease is seen as a tubular hypoechoic structure with a beaded appearance, which is the classical finding of a thrombosed vein, but not of a dilated duct which usually with smooth wall (Figure 5).[6] It is also longer in extent and will not be connected to the nipple areolar complex.[6] Similar to venous thrombosis in the body elsewhere, the distended vein is not compressible by the ultrasound probe and there is absence of Doppler signal.[5]

Mondor's disease does not require a pathological diagnosis when clinical and radiological findings are concordant. No specific treatment is needed for the disease since it will resolve spontaneously in 1 to 2 months' time.[5] Nonsteroidal anti-inflammatory drugs may be considered in symptomatic cases if not contraindicated.[5]

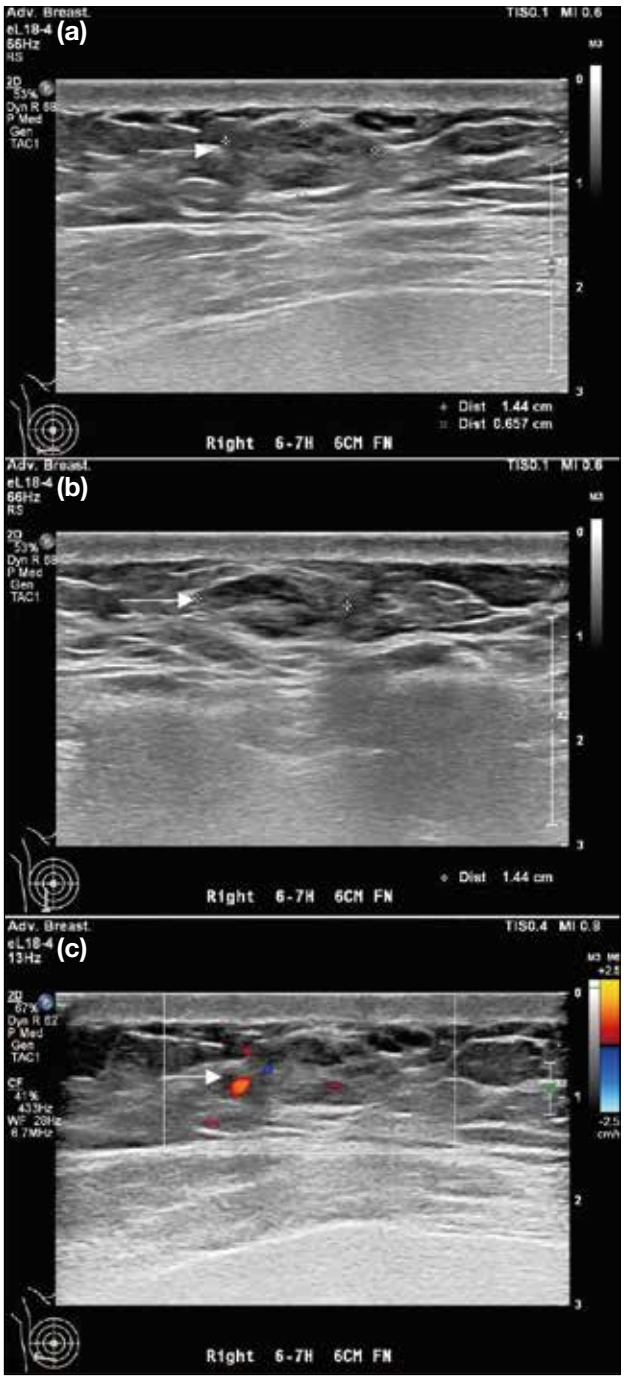

Figure 2. Cavernous haemangioma (same case as Figure 1). Ultrasound of the right breast. At the 6-7 o'clock position, 6 cm inferior to the nipple, (a, b) a 1.4 × 0.6 × 1.4 cm^3 oval, inhomogeneous, slightly hypoechoic mass (arrows) is seen, oriented parallel to the surrounding parenchyma, with microlobulated margins. (c) Mild intralesional vascularity is noted (arrow).

VASCULAR MALFORMATIONS

High Flow: Arteriovenous Malformation

Arteriovenous malformations (AVMs) are exceedingly rare in the breast, with only scant case reports. No specific mammographic features are found in AVMs. Similar

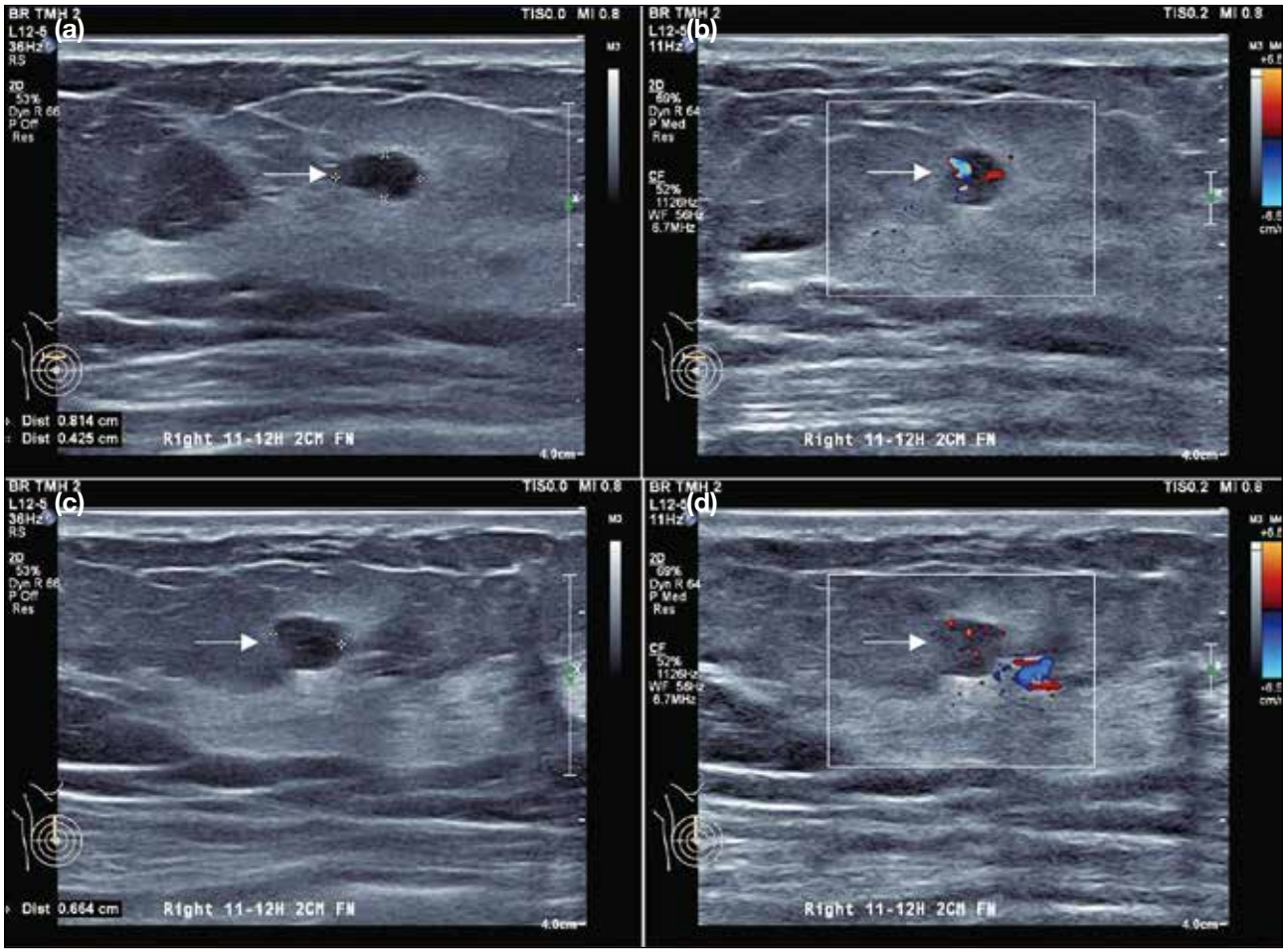

Figure 3. Another case of haemangioma. Ultrasound of the right breast (arrows in [a] and [c]). At the 11-12 o'clock position, 2 cm from the nipple, a 0.8 × 0.4 × 0.7 cm^3 oval, hypoechoic mass is seen, oriented parallel to the tissue planes, with microlobulated margins. Internal vascularity is demonstrated on Doppler ultrasound (arrows in [b] and [d]).

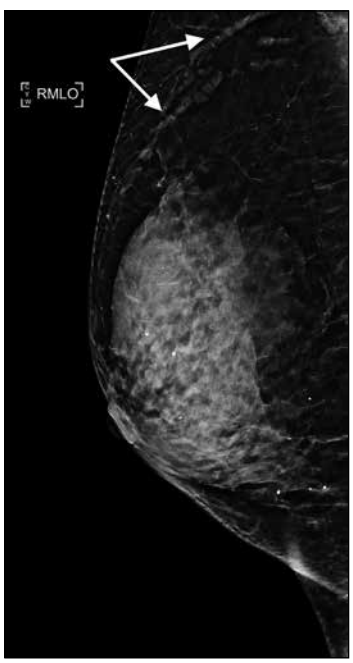

Figure 4. Mondor's disease. Mammogram of the right breast (mediolateral oblique view). A few linear equal density tubular lesions with a beaded appearance (arrows) are identified in the upper quadrant of the right breast.

to other benign vascular entities, they may present on mammography as an equal density mass with a round shape and circumscribed margins (Figure 6). They may also contain benign-appearing calcifications, indicating the presence of phleboliths.[7]

On ultrasound, they are again non-specific. In our case, the lesion presented as an oval heterogeneous hypoechoic mass with parallel orientation to the skin surface. No posterior acoustic enhancement was demonstrated. Doppler ultrasound may be a non-invasive technique to establish the diagnosis since it can demonstrate the mixture of arterial and venous blood flow within the lesion (Figure 7).[8]

Magnetic resonance imaging (MRI) can demonstrate a tangle of dilated blood vessels with progressive contrast enhancement of the lesion.[9] Blooming artefacts indicate the presence of phleboliths.[9]

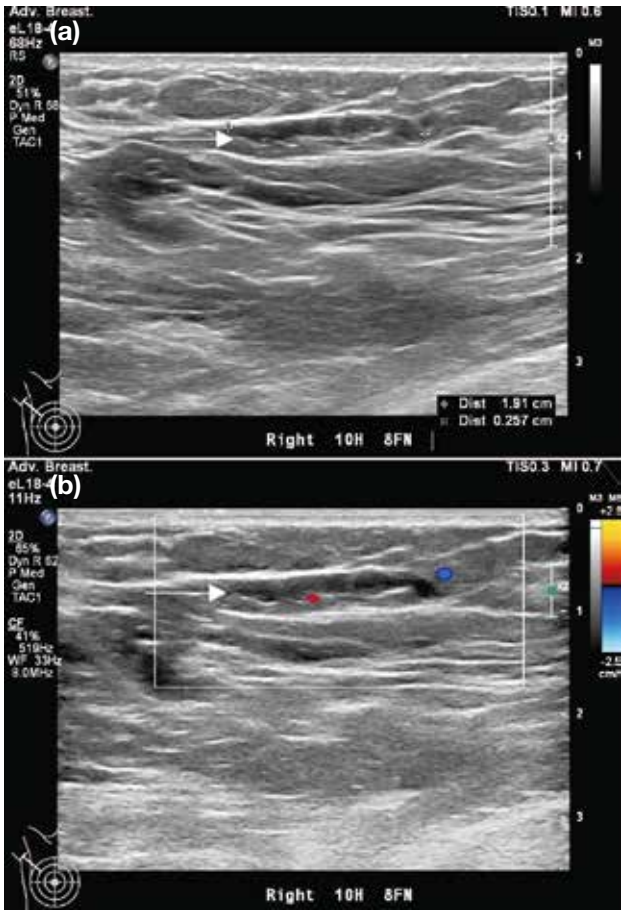

Figure 5. Mondor's disease. Ultrasound of the right breast. At the 10 o'clock position near the axilla, (a) an elongated tubular lesion with a beaded appearance is visualised (arrow). (b) No Doppler signal is detected within the structure (arrow).

The management of AVMs is dependent on the clinical symptoms. For asymptomatic and small masses, as in our case, conservative management should be considered. In case of palpable symptomatic lesions, embolisation or surgical excision would be the options.[9]

Slow Flow: Venous and Venolymphatic Malformations

Venous and venolymphatic malformations are slow-flow vascular lesions, which may be asymptomatic. Some patients present with bluish skin discolouration and even with enlarged breast volume when the lesion is more sizable.

Ultrasound can be a good initial tool to establish the diagnosis. These lesions are identified as an area of hypoechogenicity within the breast. Doppler ultrasound on this hypoechoic area will demonstrate the venous flow pattern on spectral technique (Figure 8). Other sonographic findings include echogenic foci indicating phleboliths and absence of colour uptake due to thrombosis or lymphatic components.[10]

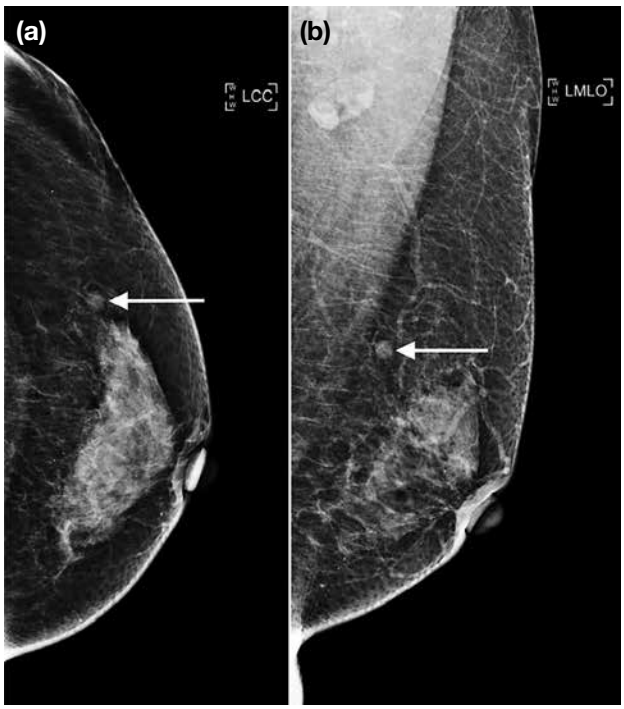

Figure 6. Arteriovenous malformation. (a) Craniocaudal and (b) mediolateral oblique views of the mammogram of the left breast. A 0.6-cm equal density round mass is identified in the upper outer quadrant of the left breast (arrows).

Venous malformations can present as T2-weighted hyperintense tubular structures. Variable unenhanced T1-weighted signal has been described depending on whether these structures contain thrombosis.[10] Enhancement could be seen on T1-weighted images after gadolinium injection (Figure 9). If phleboliths are present, susceptibility artefacts may also be seen.[11] For the lymphatic component, MRI might demonstrate septal enhancement in the background of non-enhancing lymphatic fluid.[12]

If patients are symptomatic or there is cosmetic concern, sclerotherapy, laser therapy, or surgical resection are options.[11] In our case, sclerotherapy with sodium tetradecyl sulphate foam was performed under the guidance of direct puncture venography (Figure 10), with resulting clinical improvement.

MALIGNANT VASCULAR LESIONS

Angiosarcoma

Angiosarcoma is an exceedingly rare cause of primary breast tumour, with the literature-quoted incidence rate <0.05%.[13] There are no specific mammographic findings.[13]

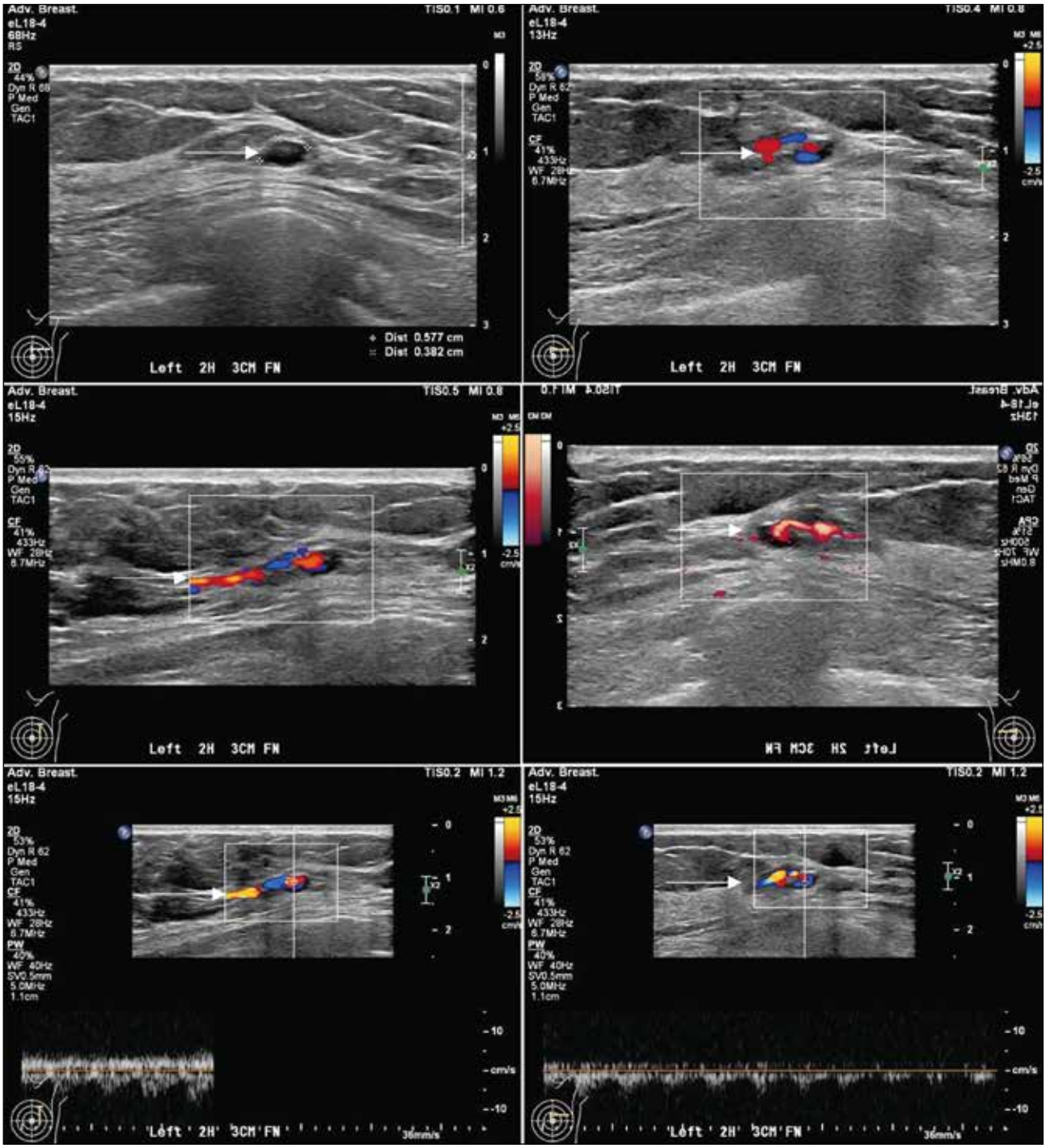

Figure 7. Arteriovenous malformation. Ultrasound of the left breast. At the 2 o'clock position, 3 cm from the nipple, a 0.6 × 0.4 × 0.5 cm^3 oval, heterogeneous, hypoechoic mass is visualised with parallel orientation and no posterior acoustic shadowing. It demonstrates internal arterial and venous flow, with communication to adjacent breast parenchymal vasculature (arrows).

On ultrasound, they show a variable echogenic pattern, usually with hypervascularity on Doppler.[13] However, as mentioned previously, haemangiomas may also demonstrate hypervascularity. Hence, this feature is not specific.

In our case, similar to other breast tumours, angiosarcomas may enhance after contrast administration on computed tomography scan (Figure 11).

On MRI scan, they showed variable signal intensity on T1-weighted and T2-weighted images. High T1-weighted signal suggests the presence of haemorrhagic products or venous lakes.[13] Elevated T2-weighted

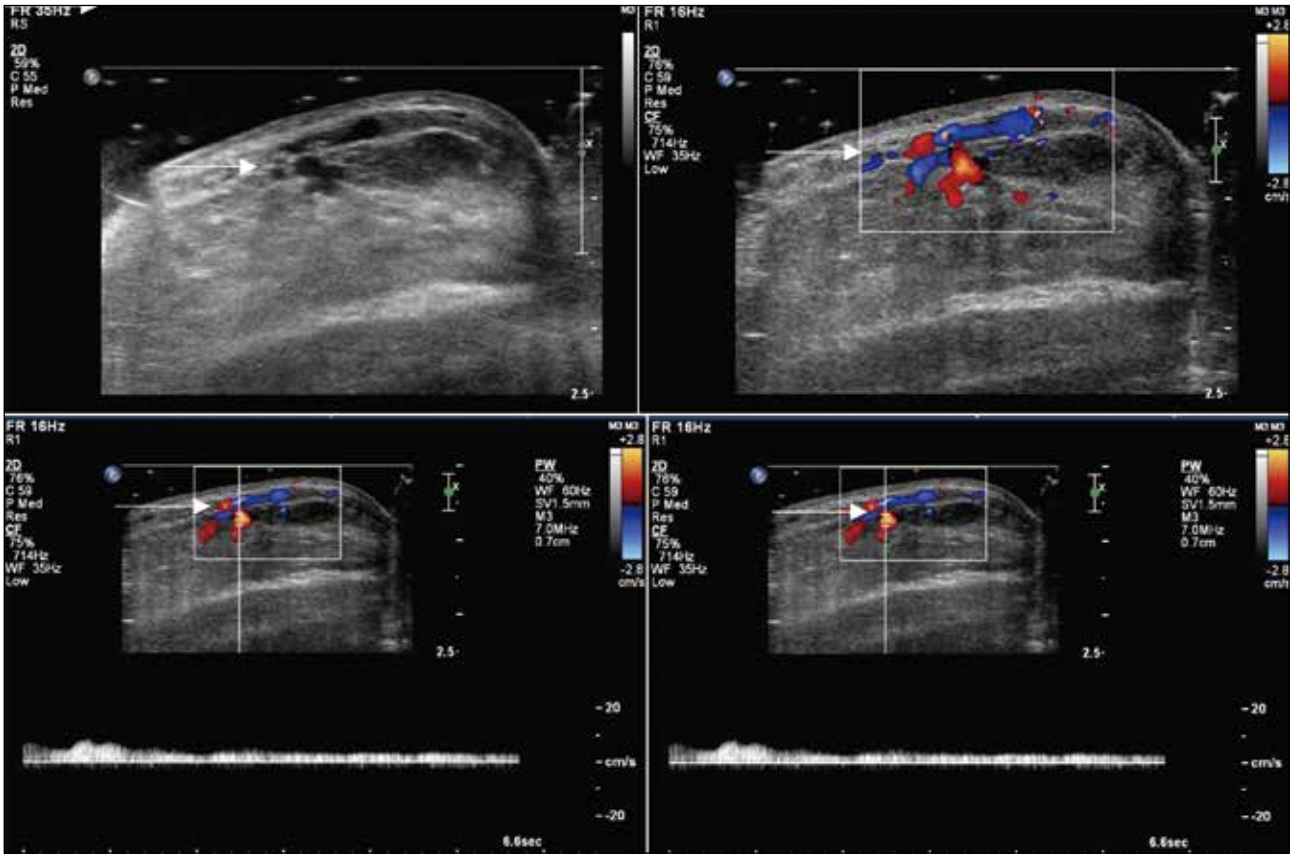

Figure 8. Venous malformation. Ultrasound of the left anterior chest wall. A hypoechoic area with tubular structures demonstrating venous flow patterns is observed (arrows). The total extent of involvement measures at least 4.3 cm along its greatest dimension.

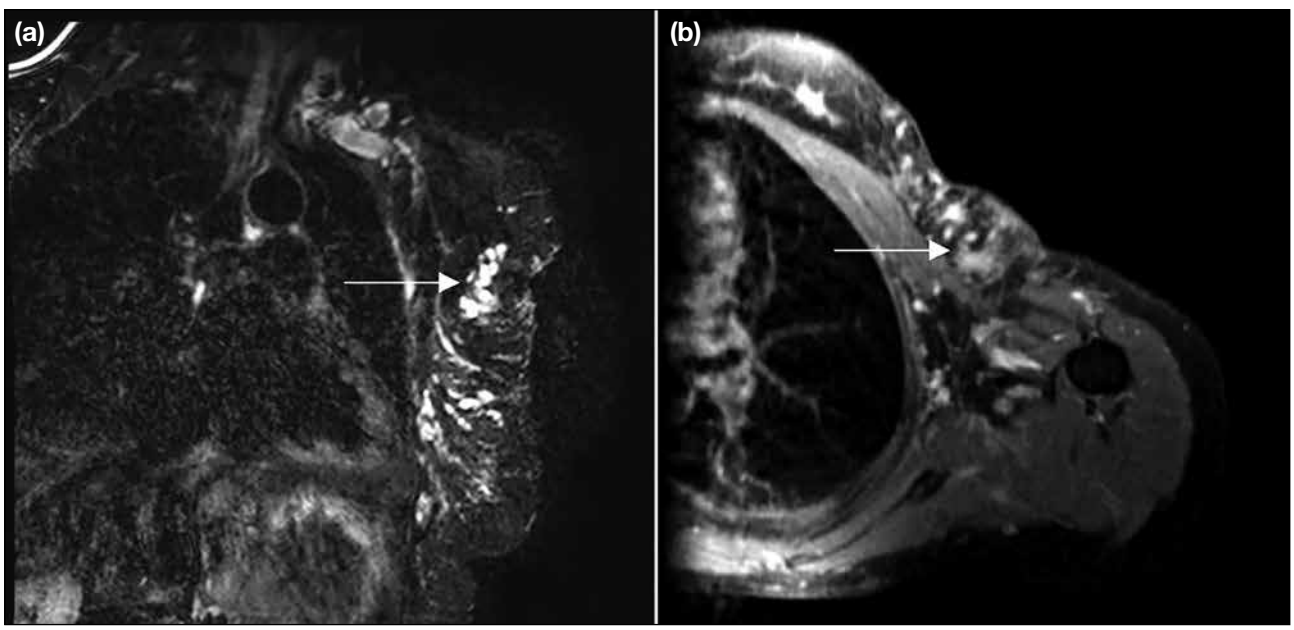

Figure 9. Venolymphatic malformation. Magnetic resonance images of the left chest wall. (a) T2-weighted coronal image with fat saturation and (b) T1-weighted axial image with fat saturation after gadolinium injection. Multiple clusters of lobulated T2-weighted hyperintense structures (arrow in [a]) with post-contrast enhancement are seen in the left breast (arrow in [b]).

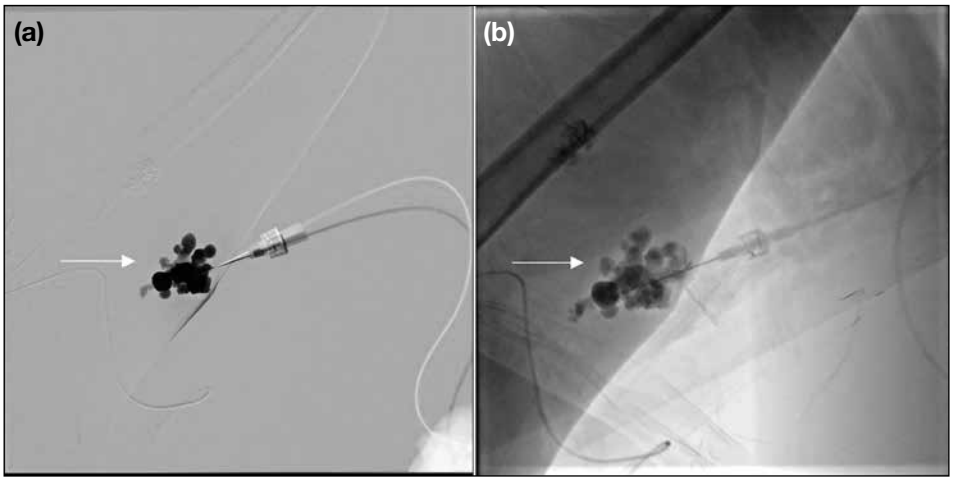

Figure 10. Venolymphatic malformation. Direct puncture venograms demonstrate (a) a slow-flow vascular malformation (arrow) and (b) the appearance following injection of an alcohol mixture (arrow).

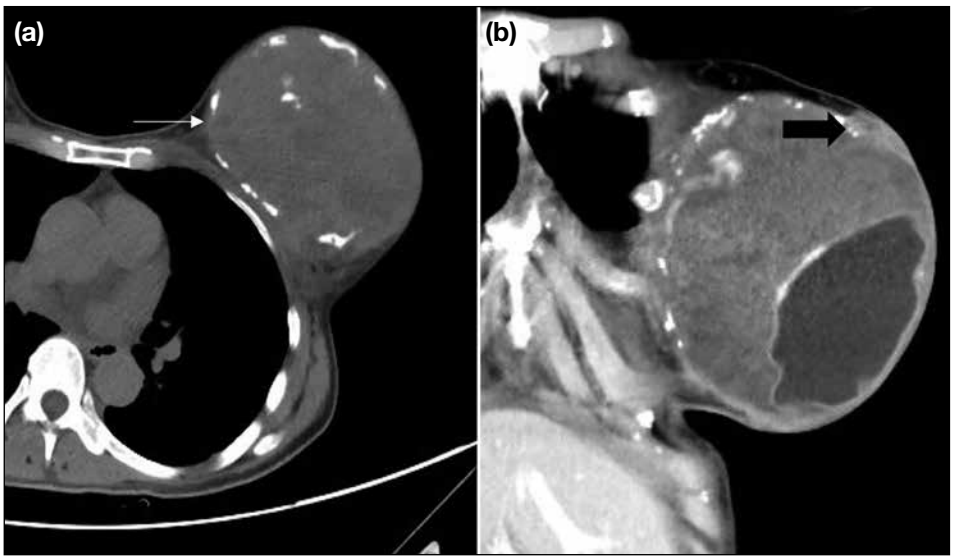

Figure 11. Angiosarcoma. Computed tomography scan of the thorax. (a) The left breast implant capsule (arrow) is seen adjacent to a heterogeneous soft tissue mass with (b) predominantly peripheral enhancement (arrow).

signals indicate the aggressiveness of the lesion with cystic degeneration and tumour necrosis.[14] They enhance, often at the periphery only, after gadolinium administration (Figure 12).[14] The kinetic characteristics of the tumours depend on their grade.[13]

Aggressive surgery remains the mainstay of treatment, while there is still no consensus on adjuvant treatment.[15] Angiosarcomas carry a poor prognosis, with the majority of the cases in our centre showing disseminated hypervascular metastases or contralateral breast metastases despite radical surgery performed after diagnosis (Figure 13).

CONCLUSION

Vascular lesions have been increasingly discovered due to increased health screening. We should be aware of the typical imaging features of vascular malformations to avoid unnecessary biopsies. While histopathological results are still required to establish the diagnosis in haemangiomas and angiosarcoma—with surgical excision remaining the mainstay of management—if the imaging features of haemangiomas are benign, such as oval/lobulated shape with well-circumscribed margins, imaging surveillance could be performed after needle biopsy.[2]

REFERENCES

1. Kim KM, Kim JY, Kim SH, Jeong MJ, Kim SH, Kim JH, et al. Breast cavernous hemangioma with increased size on ultrasonography: a case report. J Korean Soc Radiol. 2018;79:311-4.
2. Mesurolle B, Sygal V, Lalonde L, Lisbona A, Dufresne MP, Gagnon JH, et al. Sonographic and mammographic appearances of breast hemangioma. AJR Am J Roentgenol. 2008;191:W17-22.
3. Glazebrook KN, Morton MJ, Reynolds C. Vascular tumors of the breast: mammographic, sonographic, and MRI appearances. AJR

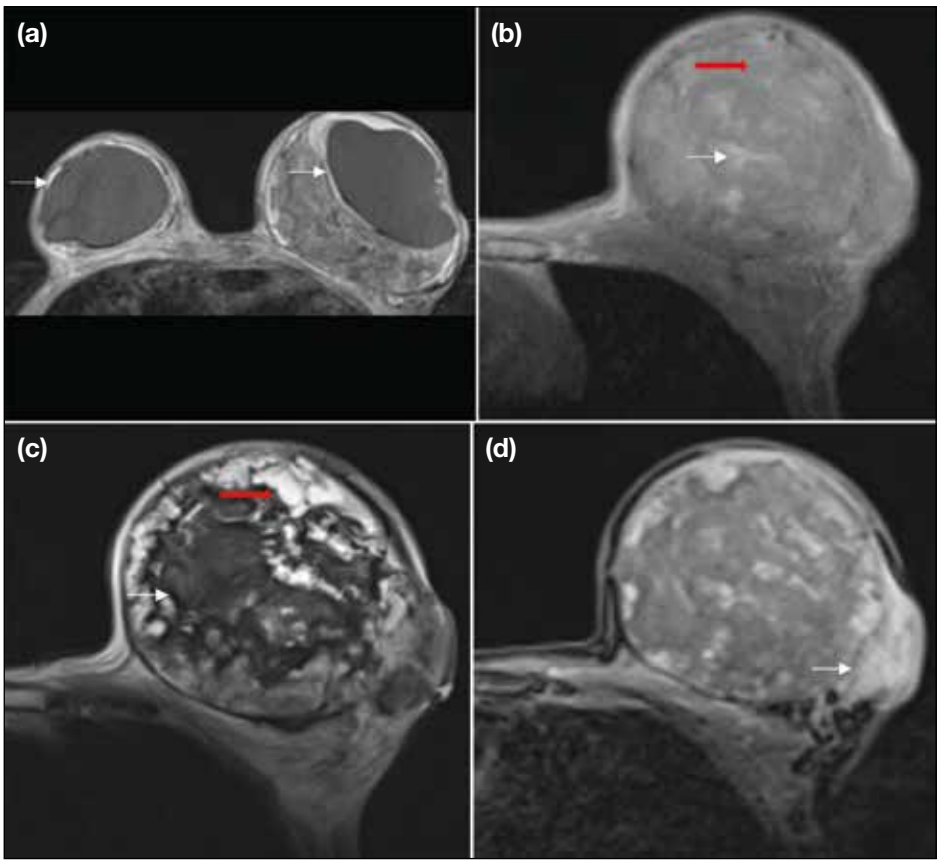

Figure 12. Angiosarcoma. (a) Magnetic resonance imaging of both breasts showing bilateral breast implants (thin arrows). Magnetic resonance images of the left breast. (b) T1-weighted, (c) T2-weighted, and (d) fat-saturated T1-weighted post-gadolinium sequences. An irregular, infiltrative solid mass is seen at the superolateral aspect of the left breast implant, showing peripheral contrast enhancement (thin arrow), particularly in the upper outer quadrant. Non-enhancing T1-weighted hyperintense and T2-weighted hypointense foci suggest tumoural haemorrhage (thin arrows), while non-enhancing T1-weighted hypointense and T2-weighted hyperintense foci are consistent with tumour necrosis (red arrows).

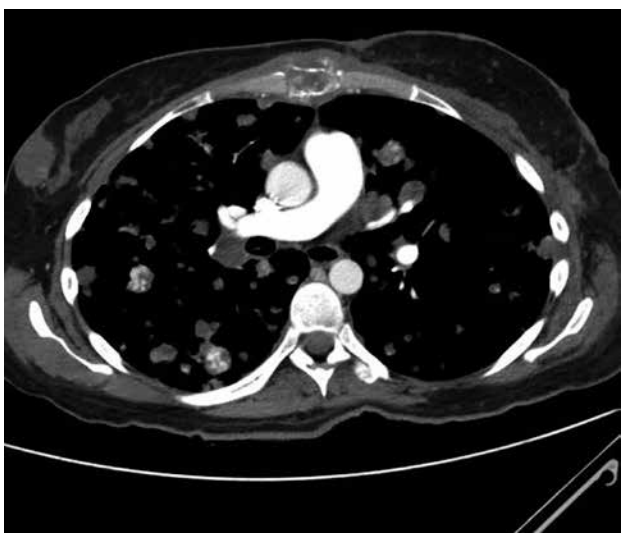

Figure 13. Metastatic angiosarcoma. Computed tomography pulmonary angiogram. Left breast mastectomy with myocutaneous flap reconstruction for previous angiosarcoma. New bilateral lung nodules are noted, along with cutaneous and subcutaneous metastases involving the reconstructed left breast and the right breast.

Am J Roentgenol. 2005;184:331-8.
4. Azam R, Mrkonjic M, Gupta A, Gladdy R, Covelli AM. Mesenchymal tumors of the breast: fibroblastic/myofibroblastic lesions and other lesions. Curr Oncol. 2023;30:4437-82.
5. Amano M, Shimizu T. Mondor's disease: a review of the literature. Intern Med. 2018;57:2607-12.
6. Shetty MK, Watson AB. Mondor's disease of the breast: sonographic and mammographic findings. AJR Am J Roentgenol. 2001;177:893-6.
7. Padmanabhan V, Dev B, Garg M, Gnanavel H. Arteriovenous malformation of the breast; report a case. Arch Breast Cancer. 2024;11:96-100.
8. O'Beirn E, Elliott J, Neary C, McLaughlin R. 32 Congenital arteriovenous malformation of the breast associated with giant hairy naevus: a case report. Br J Surg. 2021;108(Suppl 6):znab259-64.
9. Swy E, Wahab R, Mahoney M, Vijapura C. Multimodality imaging review of breast vascular lesions. Clin Radiol. 2022;77:255-63.
10. Gautam R, Dixit R, Pradhan GS. Venous malformation in the breast: imaging features to avoid unnecessary biopsies or surgery. J Radiol Case Rep. 2023;17:1-8.
11. Vijapura C, Wahab R. Multiple venous malformations involving the breast. J Breast Imaging. 2022;4:550-2.
12. Marín C, J Galindo P, Guzmán F, Ferri B, Parrilla P. Lymphovascular malformation of the breast: differential diagnosis and a case report [in English, Spanish]. Cir Esp (Engl Ed). 2019;97:541-3.
13. Glazebrook KN, Magut MJ, Reynolds C. Angiosarcoma of the breast. AJR Am J Roentgenol. 2008;190:533-8.
14. Wu WH, Ji QL, Li ZZ, Wang QN, Liu SY, Yu JF. Mammography and MRI manifestations of breast angiosarcoma. BMC Womens Health. 2019;19:73.
15. Bordoni D, Bolletta E, Falco G, Cadenelli P, Rocco N, Tessone A, et al. Primary angiosarcoma of the breast. Int J Surg Case Rep. 2016;20S(Suppl):12-5.