Full Breast Ultrasonography as Follow-Up Examination After a Complex Treatment of Breast Cancer

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9.1 Technique Particularities in Follow-Up Examinations by FBU*

The early diagnosis of a remnant or recidivated breast cancer is mandatory in long-term survival. The American Society of Clinical Oncology (ASCO) recommends only physical examination, breast self-examination, and posttreatment mammography, neglecting the remnant small parts after mammectomy/mastectomy and the remnant satellite lymph nodes. FBU has a great accuracy as a noninvasive follow-up examination of the whole region after complex treatment of breast cancer. This technique is safe, painless, and repeatable, with lower costs as compared with MRI, avoiding unnecessary biopsies and allowing early surgical reintervention.

FBU should be adapted in the follow-up examination of breast cancer, according to the type of the surgical treatment: conservative (quadrantectomy, lumpectomy) or curative (mammectomy, rarely mastectomy) with complete/incomplete axillary lymphadenectomy. By extension, any US could not be complete without Doppler characterization and (at least for the available applications) without sonoelastography, accomplishing the "full ultrasonography"; that results the US used for the breast evaluation will be generally named FBU, whatever type of breast surgery would be performed.

High-resolution linear transducers should be used for the anterior thoracic region including the axilla, supraclavicular fossa, and internal mammary artery, searching not only eventual tumor recidivate but also the surrounding small-part integrity, for the evaluation of the possibility of reparatory surgery. This analysis should be completed by Doppler and sonoelastography, avoiding unnecessary biopsies in suspect scars or local surgical complications: hematomas, seromas, suture granulomas, and remnant breast glandular tissue or remnant satellite lymph nodes with or without pathological changes.

Conservative surgery implies the examination of the remnant breast upon the DE technique, respecting the radial and antiradial scanning, with detailed explanations concerning the scars and the surrounding structures. In the last years, transducers were adapted with long scanning surfaces of 6–9 cm in lengths and/or water-bag devices, allowing the radial scans with better accuracy than the panoramic nonstandardized view-type SieScape technique. Antiradial scans or even oblique scans along the scar axis may add useful information, as focused second step examinations after the radial comprehensive scanning, which is mandatory for avoiding "blind"/omitted regions of interest.

The DE technique is proving better sensibility than the classical US and a more objective reporting of the location of any abnormality benign or suspect over 0.4 mm upon the clockwise notation [2], which is already used by the clinicians and present in the pathological reports. When DE is completed by Doppler and SE upon the Ueno/Tsukuba scoring [3], whatever the ultrasonographic machine provider, then the FBU is achieved and the specificity of the diagnosis is increased up to 95–99 % [4, 5]. If available, strain ratio calculated as FLR can be assessed to be of malignant type if measuring over 4.70 (5.00) [6].

In cases with previous mastectomy/mammectomy, FBU should be applied to the *whole anterior thoracic region*, represented by:

- *The homolateral area* from the supraclavicular fossa to the submammary line and from the axilla and external thoracic artery to the presternal small parts and internal mammary artery, with systematic research of the scars and surrounding small parts, using axial, sagittal, and oblique scans, panoramic views, and high-resolution high-frequency transducers, according to the specific findings.
- *The contralateral breast* is examined upon the DE of Teboul accomplished as FBU, including the satellite lymph node stations, because of the risk of developing contralateral metachronous malignancy; moreover, the contralateral breast may provide information about the structural type of breast, with the dense breast being more susceptible to develop a malignant lesion. Any benign pathology should be mentioned in the remnant breast.

*(Chapter based on the author's presentation in collaboration with ME Andrei, at EPOSTM Vienna 2015, DOI:10.1594/ecr2015/C-0266 [1]).

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In conclusion, in the follow-up of breast cancer, we should apply FBU to the whole anterior thoracic area, from the supraclavicular lymph nodes to the submammary sulcus and from the external thoracic artery and lymph nodes to the internal mammary arteries and node chain. For any adenopathy found in a lymph node station, the research area must be extended, for instant the presence of any suspect lymph node in the supraclavicular fossa push the limits to the deep lateral cervical nodes, up to the suboccipital spinal nodes, which are be found in advanced stages.

9.2 Findings in the FBU Follow-Up Examinations of Breast Cancer

The utility of the follow-up examination in breast cancer treatment is multiple, and full US could be the best noninvasive technique, with the following aims:

1. *To determine the remnant breast cancer, in the conservative therapy or radical mastectomy.* Indeed, there were reported at least 13.5 % positive margins at initial resection [7]; moreover, in a similar rate of positive margin, the local recurrence reported was very important, of 35.62 % cases, located in the intact breast, on the chest wall, in the axilla, in the supraclavicular fossa, and rarely in the internal mammary chain [8]. The authors did not mention the methods of diagnosis, but all these locations are available for FBU. There seemed to be no significant increased risk of second malignancies in patients undergoing conservative treatment (lumpectomy and radiation therapy) versus mastectomy without radiation [9, 10]; Obedian et al. [11] found in both cases 10 % rate of risk of second breast cancer at a 15-year survey. We think an earliest detection of the remnant cancer in the breast, the chest wall, or the satellite lymph nodes is possible after 3 weeks from the surgical treatment, and this is essential before completing the oncological protocol; any incomplete follow-up diagnosis will increase the risk of tumor recidivate. A six-month-interval follow-up FBU may be useful in the screening of breast cancer after complete or during the complex treatment, at least up to 5 years of survey; the malignancies detected may have different etiologies, according to the time from the first cancer: "forgotten" (missed tumors, either the main tumor if small in dense breast or associated lesions in multifocal cancers), "recidivate" (incomplete resection, usually malignant scar or developing adenopathies), and new malignancy (metachronous, multicentric, others).
2. *To differentiate a benign keloid from a malignant scar:* 2D US and SE may be similar in both scar types, but Doppler signal was increased in recidivate to the surgical positive margin; the initial negative margin on frozen examination may turn in positive margin with intraductal carcinoma on the permanent pathology, while the frozen positive margin at initial resection may be significantly associated with lobular histology [7]; in our experience, the initial lobular cancer was frequently multifocal, so the risk of remnant malignant foci from the same mammary lobe is increased in incomplete lobar resection, as was assumed by "the theory of the sick lobe" of Tot [12].
3. *To estimate the risk of metachronous breast cancer in the same or in the contralateral breast:* in FBU, it is possible to examine any abnormality of the ducts and lobules in the dense breast, to discriminate the ductal and lobular hyperplasia with premalignant increased risk, especially in postmenopausal patients, from duct ectasia or nodular fibro-micro-cystic dysplasia, with low potential for developing breast cancer.
4. *To illustrate the benign associated lesions*, usually neglected in patients with breast cancer, but with significant impact on the quality of life and sometimes on the treatment protocols; the chronic overinfected galactophoritis and the fibrocystic dysplasia were the most frequent associated lesions. Another usual "complications" reported in breast surgery are local infections, lymphedema, and suture granuloma; the rates of infections in breast and axillary incisions are reported between 1 and 20 % [13]; therefore, we think that the presence of the pathogen Staphylococci is wrongly attributed to the contamination from the skin during surgical or postoperative maneuvers, but we found it in the preoperative nipple surge. Other pseudomalignant findings may be chronic seroma/hematoma, inspissated cysts, benign tumor especially with periareolary location (papilloma, fibroadenoma), and nodular fibro-micro-cystic dysplasia.
5. *To precise the imaging distinction of the multifocal from the multicentric breast cancer* [14]: that is better illustrated by FBU, because the multifocal cancer is connected to the same lobar branching duct, it is decreasing in size with the distance from the main tumor, with salient abnormal Doppler signal present in the first 3–4 mm of any malignant lesion, while the strain ratio is according to the size and the malignancy, too; otherwise, multicentric cancers are located in different mammary lobes, without ductal interconnection as demonstrated by Cooper since 1840 [15], without correlation in size, and with possible differences in their malignant characters.

In a retrospective analysis of 142 (11.07 %) examinations in 87 patients after surgical radical or conservative therapy and partial/complete oncological treatments (chemotherapy, hormonal therapy, radiotherapy) of breast cancer, which were included in total 1283 random FBU (Jan. 2009–Feb. 2014), we found [1]:

- *17/142 cases of remnant/recidivate cancers*, most of them in the first year of follow-up, usually in the same breast after conservative/radical breast cancer surgery, in satellite

"forgotten" lymph nodes, or in the contralateral breast and axilla; the high rate of the remnant/recidivate breast cancer of 11.97 % is similar to the values found in literature, and most patients studied after surgery were previously investigated using the worldwide accepted diagnostic tools: mammography, complementary classical US or FBU, biopsy, and rarely breast MRI. Except for FBU and MRI, other methods are considered not accurate in multifocal or multicentric breast cancer [14]; DE was useful in detecting small multiple malignant lesions because it is an anatomical imaging technique and almost all malignancies are related to the ductal tree. The advantage of the FBU was the early detection in the first year of almost all remnant/recidivate cancers, with the risk being less than 5 % after 2 years.

- *Up to two synchronous and up to four metachronous breast cancers in the same/contralateral breast* were found after an initial breast cancer with conservative/radical surgery, usually with different cellularities (multiclonal), proving multicentric cancer. From 3 cases, with initial ductal carcinoma in situ, one patient with conservative surgery followed by radiotherapy developed invasive ductal carcinoma in the same breast in the next 14 months.
- *Edema: Benign lymphedema* had less vascular pattern on Doppler, and the strain of the glandular structures was reduced as compared with the thickening skin and the premammary fatty tissue, while *carcinomatous mastitis* presented more salient vasculature and a reduced elasticity of the glandular part. In some cases, upper limb edema was proved to be undetermined by the axillary lymph node excision, but secondary to the axillary vein thrombosis, with increased incidence after intravenous chemotherapy; venous Doppler examination proved the venous valve with echogenic content and the laminar or absent blood velocity of the central lumen.
- *Biopsied tumors:* Malignant tumors could be too large at the first presentation and the surgical treatment was delayed; follow-up examination was demanded after biopsy and preoperative chemotherapy, and the imaging sonographic diagnosis proved essential complementary information related to the size, vascularity, and surrounding tissue alterations; as a positive response, the size diminished, the vascular pattern was according to the size, the acoustic shadowing if present diminished, and a better delineation with the pectoral fascia could be demonstrated.
- *In 4 cases, we found remnant cancers* missed by the initial diagnosis by mammography and classical US and omitted by the surgical treatment because of the *peripheral location* of the tumors, such as the submammary sulcus (2p), parasternal area (1p), and the outer breast border on middle axillary line (1p). These locations had the greatest risk to be omitted by screening mammography and US, and breast MRI was not recommended as routine examination. Moreover, after mammectomy, preferred for a radical surgery, we frequently have found mammary remnants of the peripheral glandular tissues without pathological changes or with benign aspects such as fibrocystic dysplasia;
- The most *"forgotten" axillary lymph nodes* were benign, with normal architecture or inflammatory changes, some of them presenting further malignant evolution at the follow-up FBU. In most cases, malignant remnant lymph nodes were found in the homolateral axilla, especially in the retropectoral and apical group; in the contralateral axilla, metastatic lymph nodes were rarely found especially after initial massive invasion of the homolateral axillary lymph nodes.
- *Other lymph node stations*: The internal supraclavicular lymph nodes and the deep lateral cervical and spinal chain involvement were exceptionally found. The internal mammary lymph node chain was detected by Doppler US in only one patient from 87 cases, with primary breast cancer located in an upper-inner quadrant; the integrity of this chain in the rest of cases was verified by the Multidetector Computed Tomography performed as routine follow-up examination at 6 months interval during the oncologic treatment; the accuracy of the Doppler US for the internal mammary lymph nodes was proved in the literature [8], but the incidence of their involvement was not so important as it was expected.
- The most difficult diagnosis in FBU was the assessment of the remnant enlarged *lymph nodes presenting necrosis* with a BGR scoring upon Ueno; the strain ratio or FLR may be reduced under 4.00 as in benign cases, the vasculature may be increased pericapsular specific for malignancy or appears normal, while MRI diagnosis is confusing, too; FNAB may be unuseful because of the necrosis. In our experience, the oncologists preferred to recommend a supplementary radiotherapy instead of repeated surgery, with good results.
- *The differential diagnosis* of a remnant/ recidivate breast cancer from other malignancy with the same location was possible by FBU in skin tumors (epithelioma, malignant melanoma), lymphoma, and sarcomas.
- *Early postsurgical complications:* In the first 6 months of follow-up, we found 51 (35.91 %) postsurgical "benign" abnormalities (seroma, hematoma, suture granuloma, lymphedema).
- 74 (52.11 %) cases presented *additional primary benign breast pathology*: ductal-lobular hyperplasias, ductal ectasias, papillomas, fibrocystic dysplasia, etc.
- Benign scars had sometimes pseudomalignant aspects in classical US or SE alone, but FBU made the differential diagnosis. FBU offered a good management of benign associated abnormalities, useful for the differential diagnosis and treatment, thus resulting in an improvement of the quality of life.

Most cases presented various association of findings, benign, postsurgical, and eventually malignant, determining a complex evaluation and a personalized treatment. Nodular

fibro-micro-cystic dysplasia was the best mimicker of malignancy on mammography and 2D US, but the absence of new vasculature and the summation-BGR score in SE allowed positive diagnosis.

In conclusion, screening FBU at the mastectomy site proved useful, safe, painless, and cheaper than any other techniques. US is also recommended for the diagnostic of surgical involvements or for radiotherapy side effects, as well as for the control of the remaining breast structures after lumpectomy or partial breast excision or after aspiration biopsy or cryoablation. Radiotherapy may be harmful, and US offers the best imaging evaluation because of the highest resolution and of the possibility to estimate the vitality based on the vasculature presence. Breast reconstruction (implants, slipped muscular-cutaneous flaps) after mammectomy can be accurately examined by FBU (Figs. 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 9.11, 9.12, 9.13, 9.14, 9.15, 9.16, 9.17, 9.18, 9.19, 9.20, 9.21, 9.22, 9.23, 9.24, 9.25, 9.26, 9.27, 9.28, 9.29, 9.30, 9.31, 9.32, 9.33, 9.34, 9.35, 9.36, 9.37, 9.38, 9.39, 9.40, 9.41, 9.42, 9.43, 9.44, and 9.45).

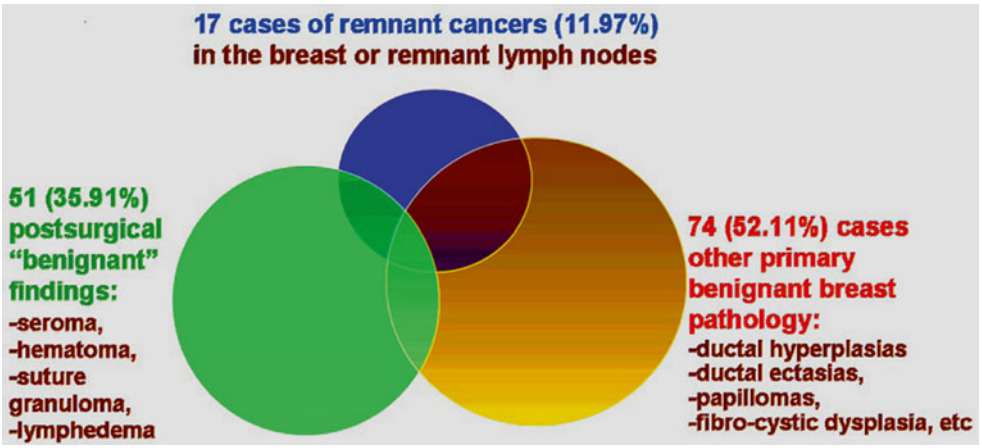


Fig. 9.1 Possible associations of the pathological findings found in breast cancer follow-up using FBU (upon [1])

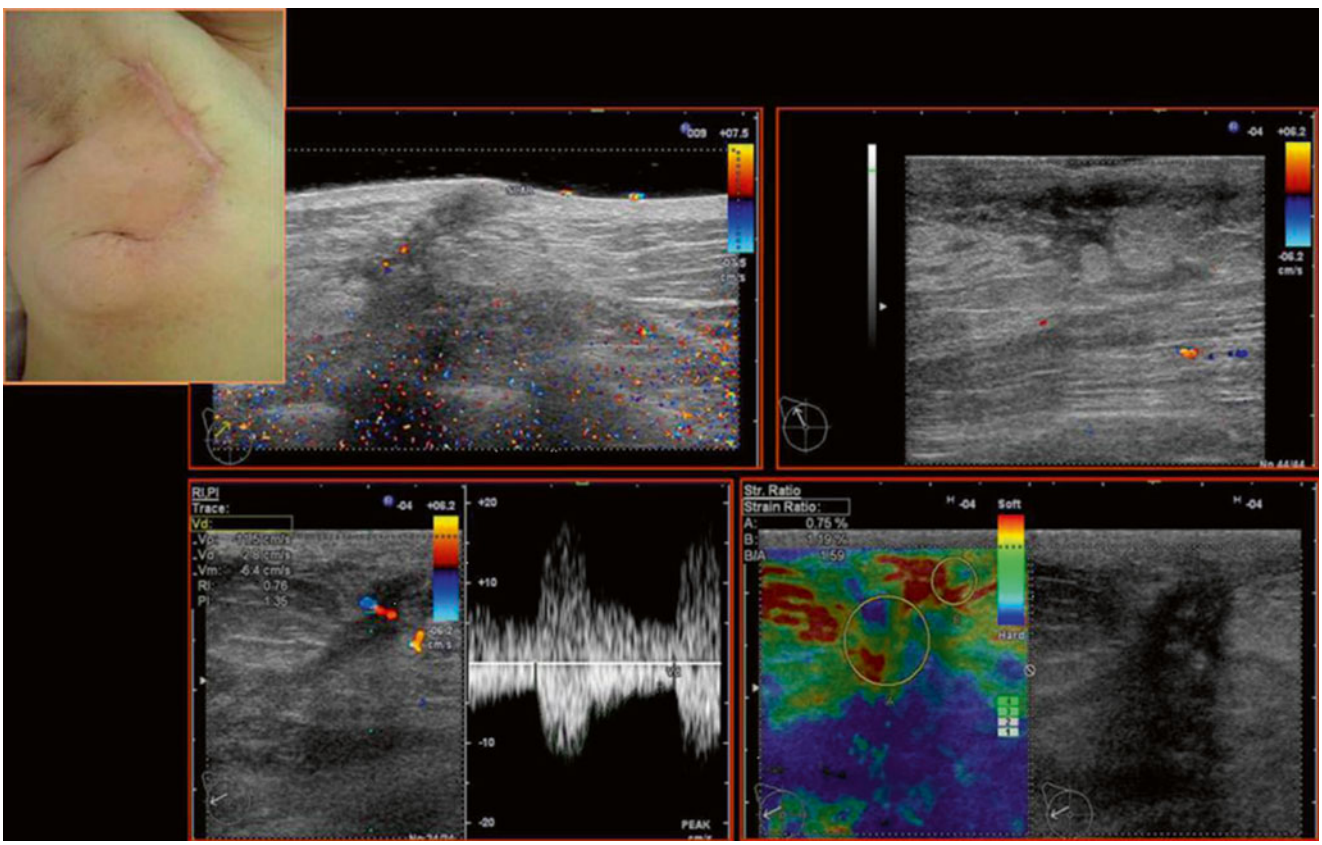


Fig. 9.2 FBU in a 45-year-old patient: benign scar with deep pseudomalignant keloid (upon [1])

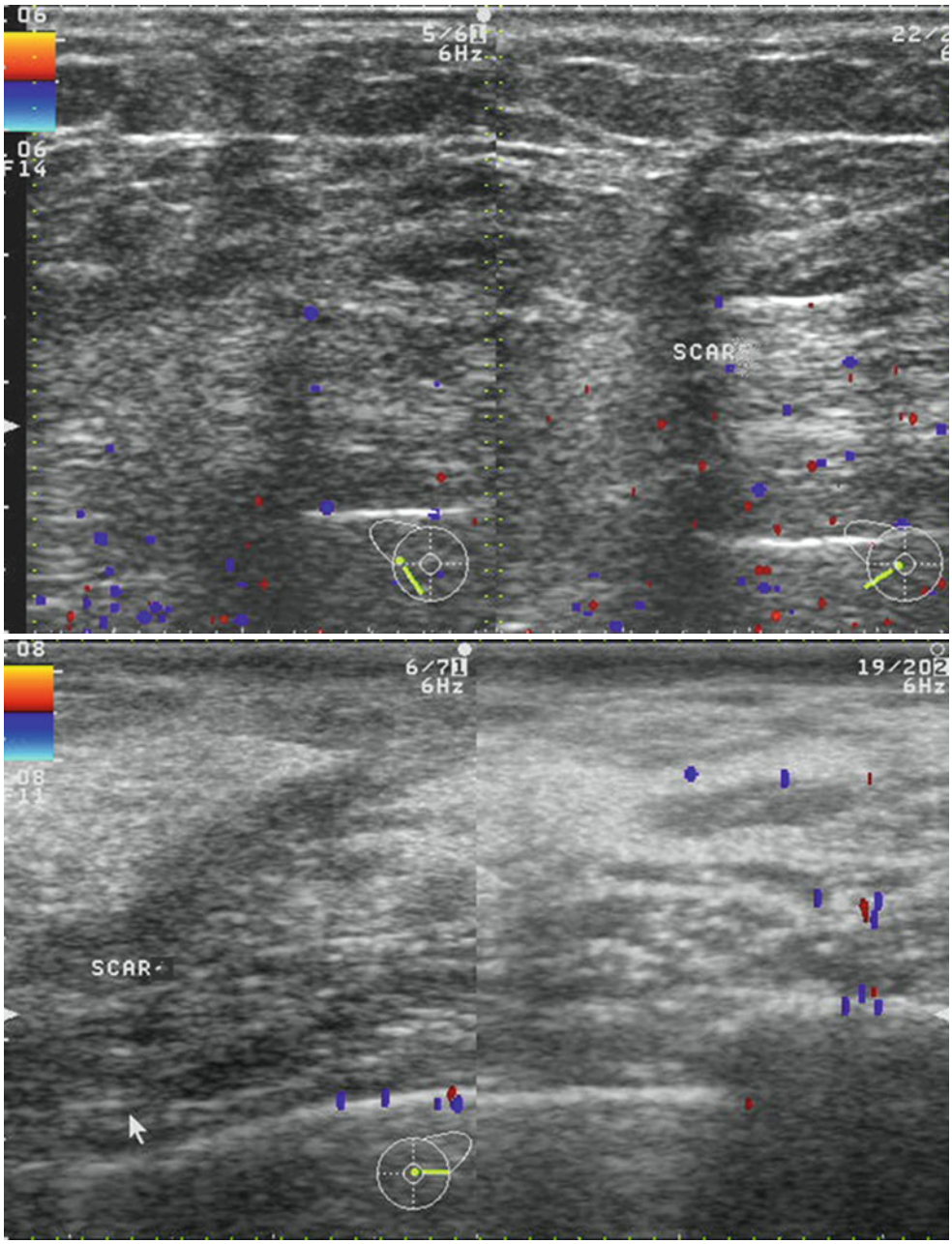
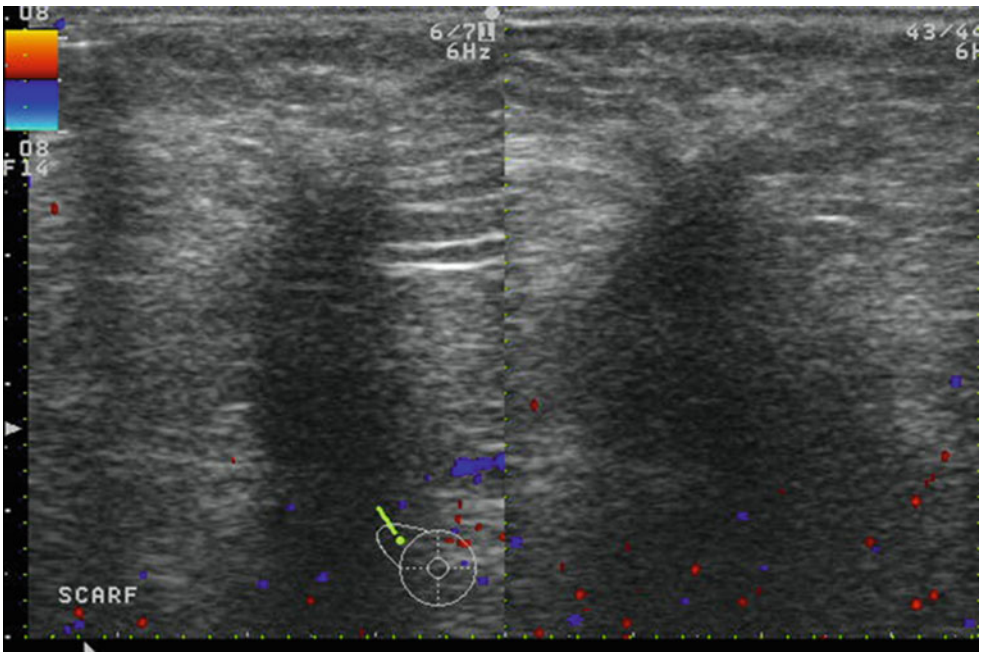


Fig. 9.3 Different shapes of scars, mimicking malignant lesions: history, real-time multiplanar scans, and absence of Doppler signal are usually sufficient argues for the diagnosis; sonoelastography could be used as a complementary tool

Fig. 9.3 (continued)



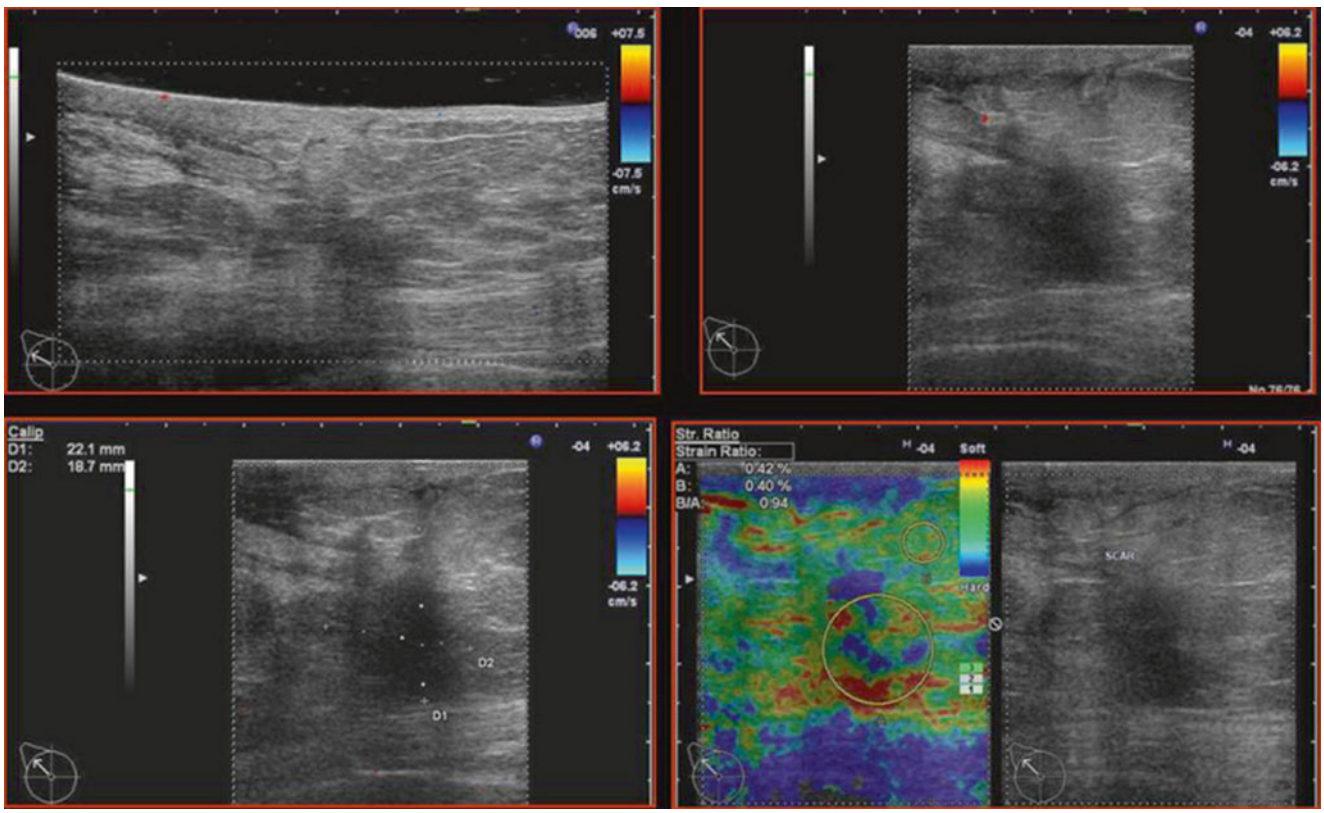


Fig. 9.4 A 48-year-old patient with R 10:30 pseudotumor on mammography and 2D US after conservative breast cancer surgery. FBU demonstrates benign scar without salient vasculature and with a complex BGR score in a chronic seroma (upon [1])

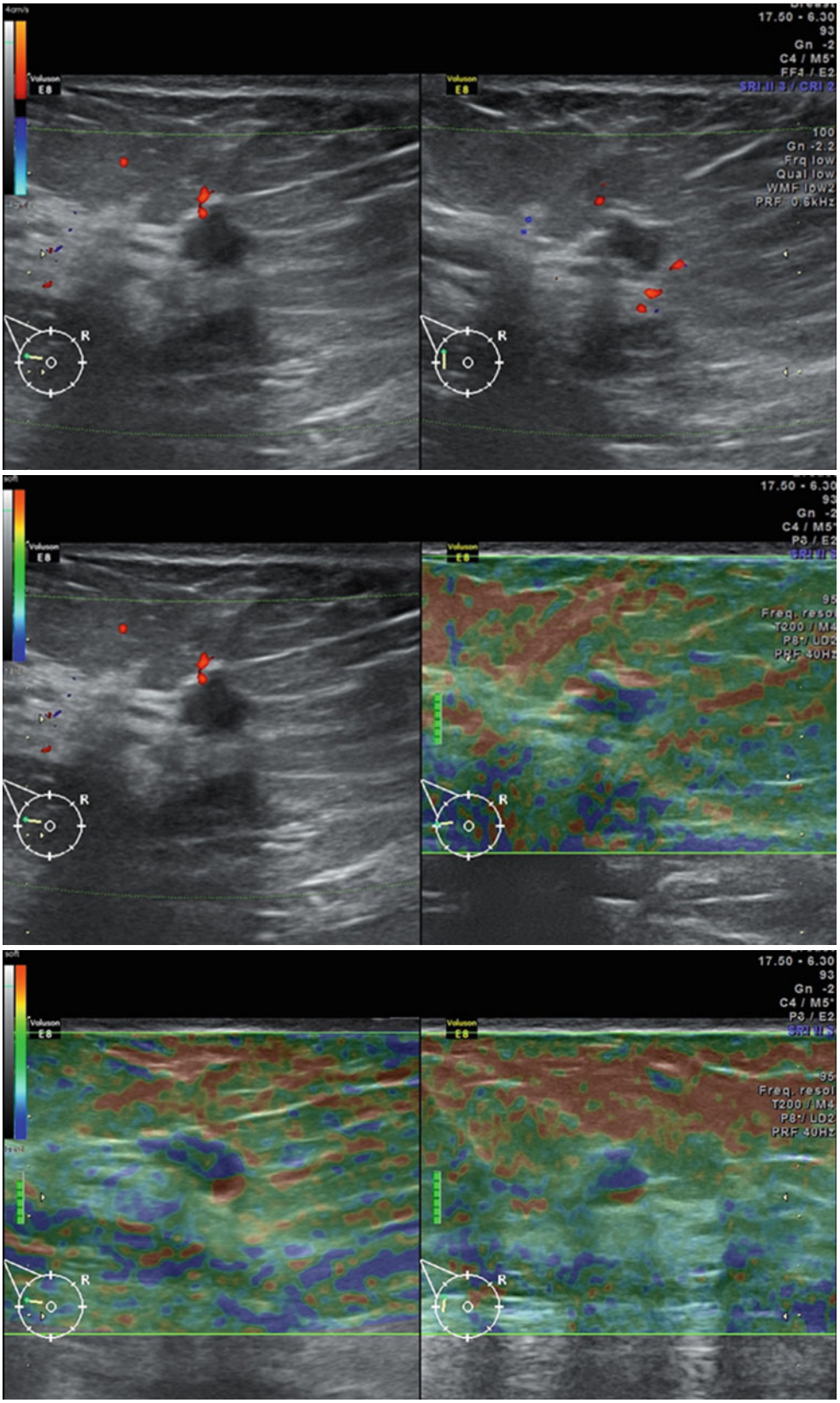


Fig. 9.5 A 60-year-old patient with left mammectomy: R 9:00 pseudomalignancy located in a TDLU, with angular margins, salient peripheral vasculature, irregular acoustic shadowing, and BGR score at sonoelastography, suggesting nodular fibro-microcystic dysplasia (upon [1]). A short-time FBU follow-up is recommended

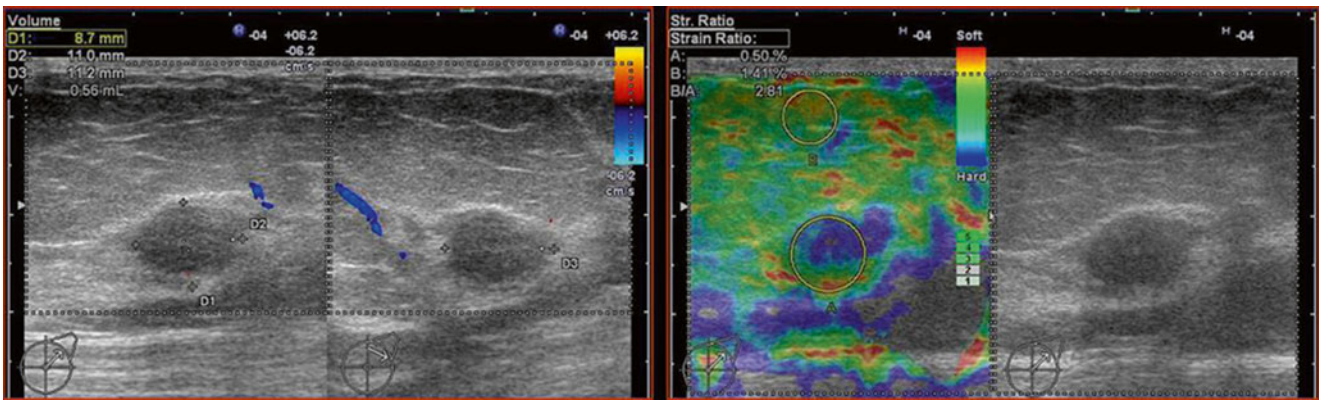


Fig. 9.6 FBU in a 51-year-old patient: remnant pseudotumor—inspissated cyst in the vicinity of the scar, with BGR scoring (upon [1])

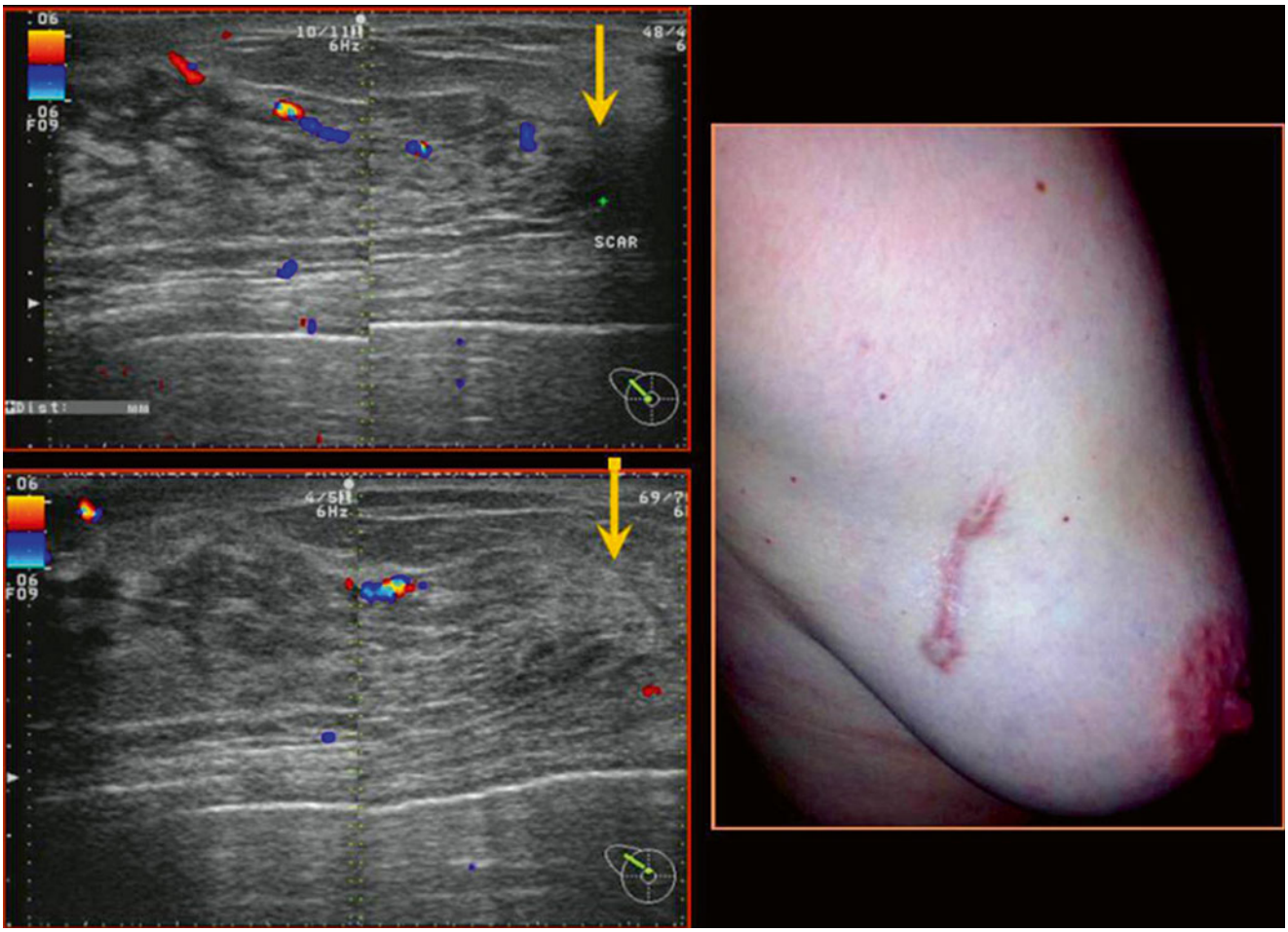


Fig. 9.7 DE in a 34-year-old patient with breast cancer in dense breast with benign scar (*arrow*): illogical lumpectomy instead of lobectomy, with increased risk of intraductal spreading; salient centripetal vasculature recommends a short-time follow-up (upon [1])

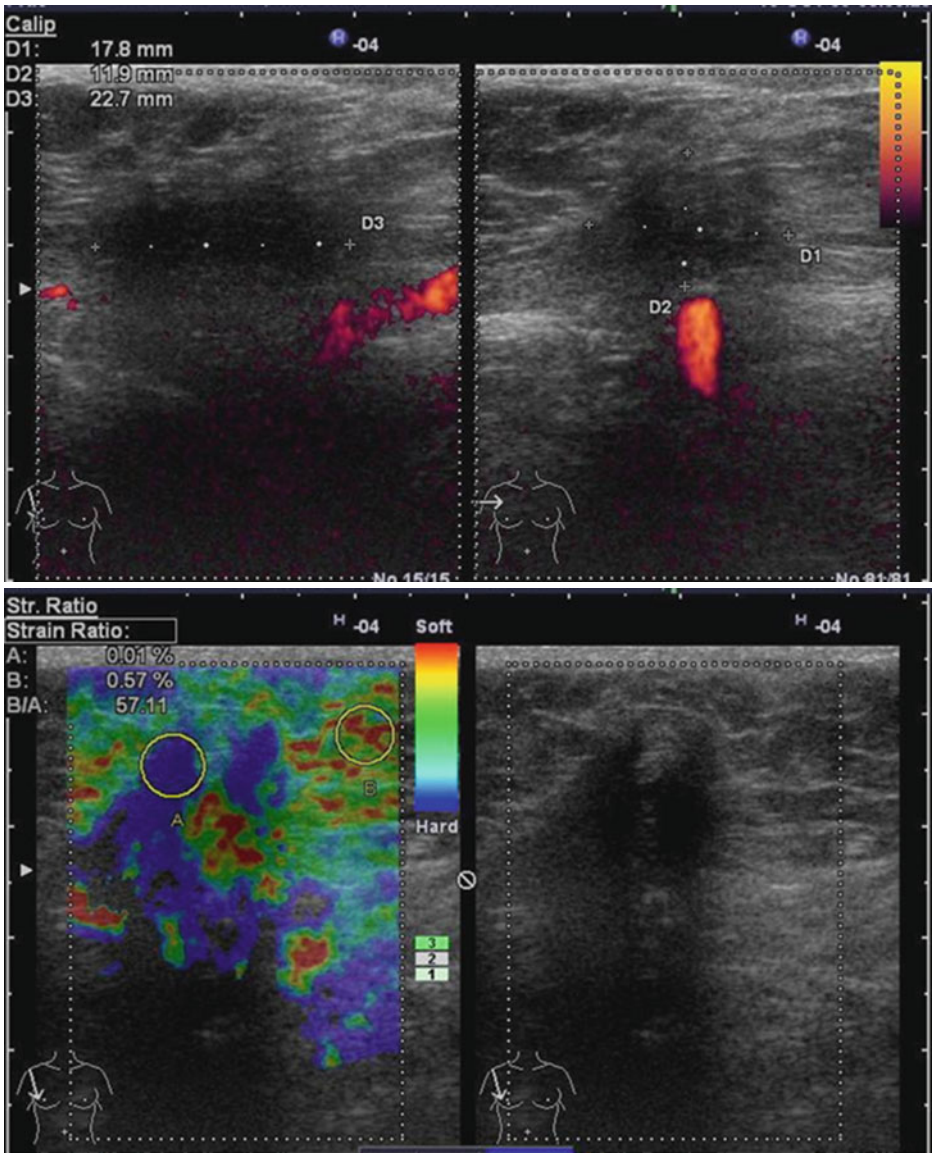


Fig. 9.8 A 43-year-old patient with benign axillary scar presenting a spiculated shape on CT and 2D US, but a complex score type 3 Ueno combined with BGR; the absence of any new formation vasculature inside the lesion reinforces the differential diagnosis with a malignant scar

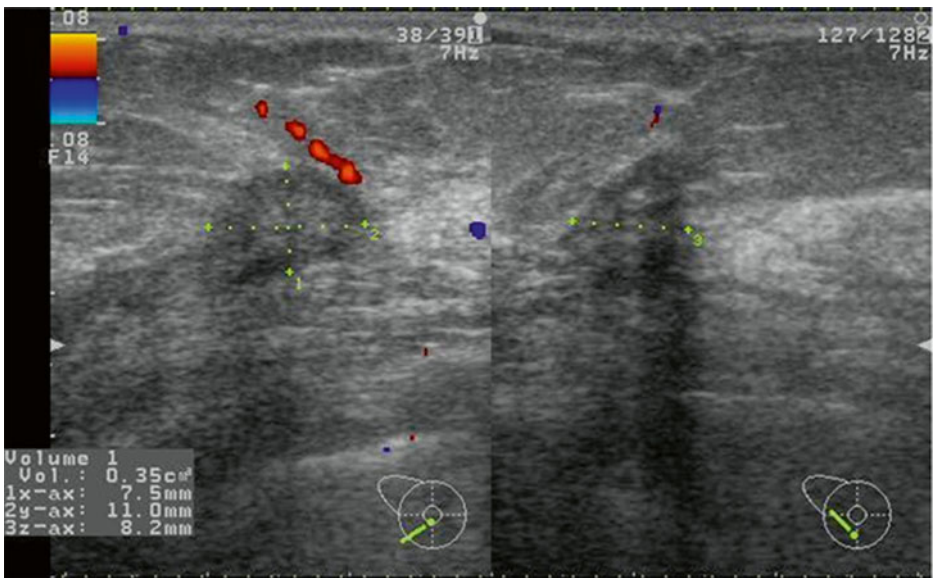


Fig. 9.9 Pathological scar: nodular inhomogeneous lesion, irregularly shaped, with posterior asymmetrical shadowing, may represent a suture granuloma; because of the peripheral new vasculature, a sonoelastography and short-time US follow-up are recommended instead of biopsy

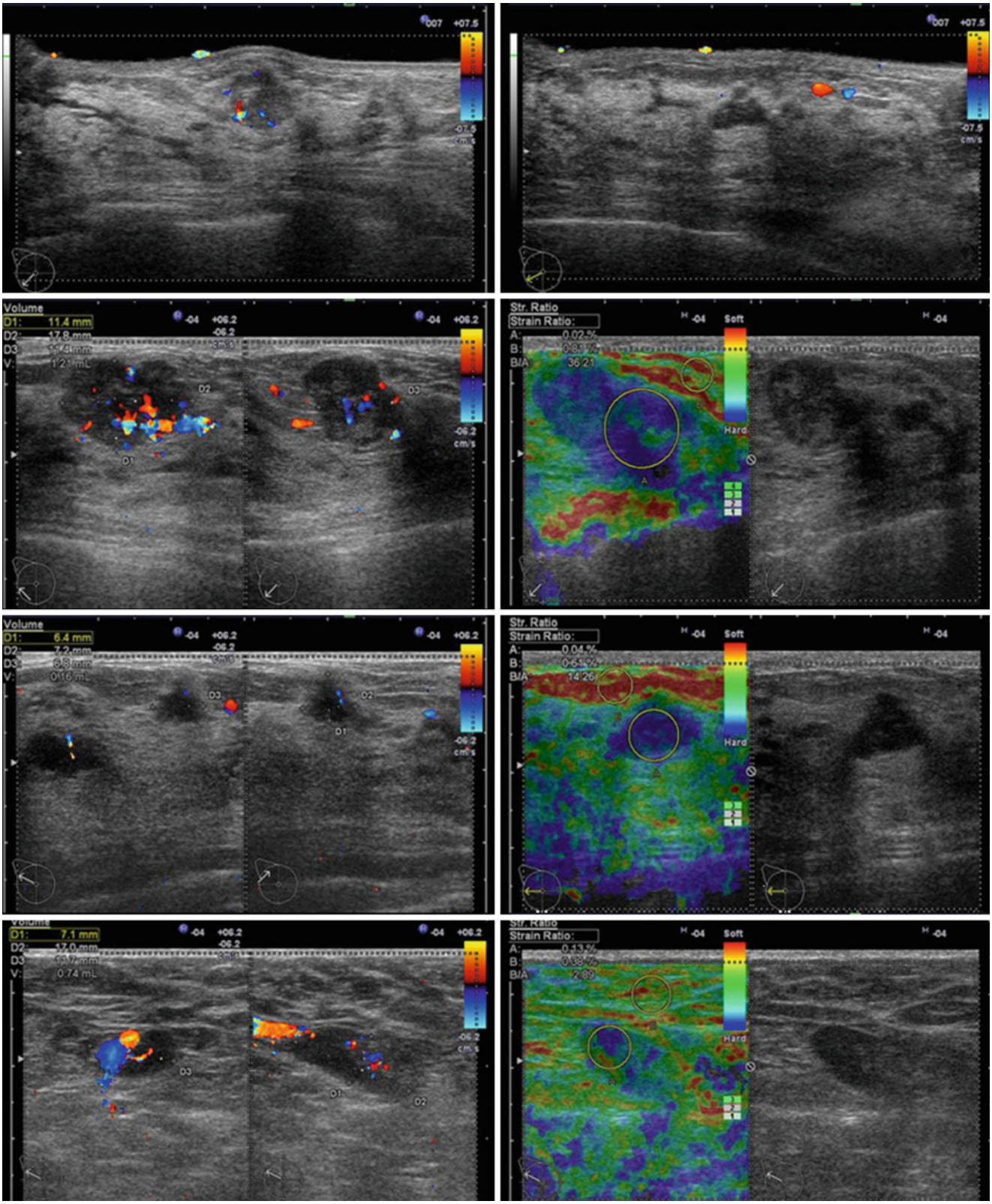


Fig. 9.10 "Multicentric" cancer in the R breast outer (different) quadrants, upon the arbitrary definition; "multifocal" cancer from the R 8:00 to R10:00 radius, according to the morphological characters, ductal connection and decreasing size from the lower tumor to the upper one, the nearest to the axilla, in the spreading way of the malignancy. The risk of "forgotten" tumor is increased if the real extension of the disease is misdiagnosed, in this large mammary lobe partially extended in 2 different quadrants (EPOS™ Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

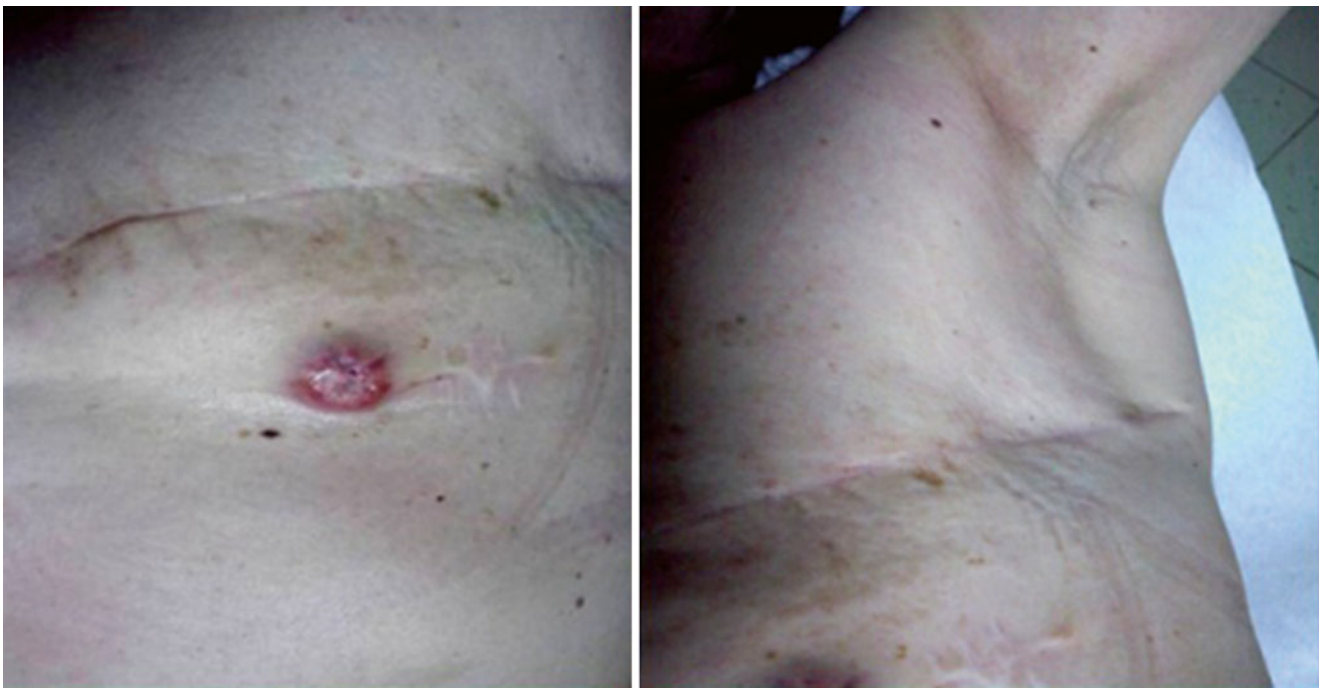


Fig. 9.11 A 64-year-old patient: mammectomy without any breast cancer findings on the specimen, but 7/15 left axillary lymph nodes were found with metastases from breast carcinoma. Aspect after 10 months, following chemotherapy, without radiotherapy (EPOS™ Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

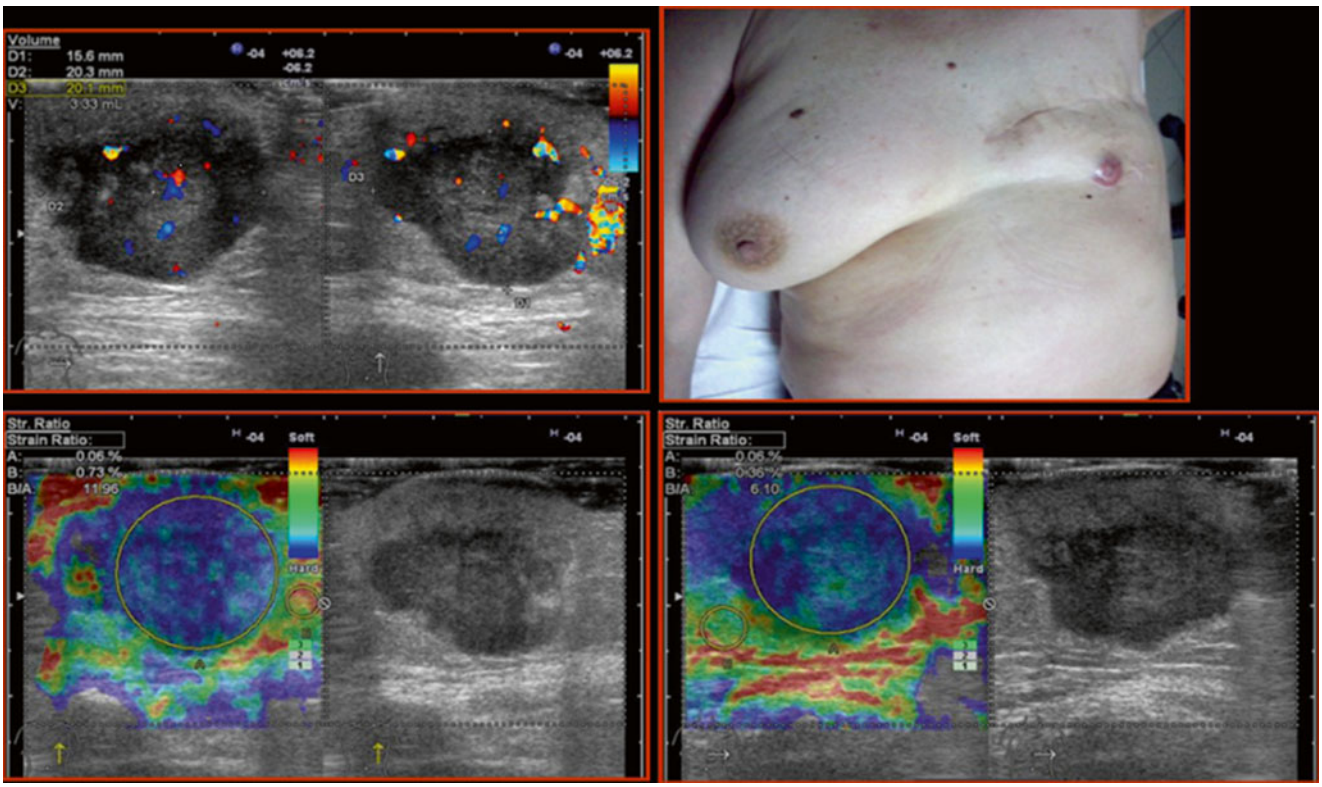


Fig. 9.12 The same case: remnant primary malignancy or recidivate? The tumor location corresponds to the submammary sulcus. Remember no cancer was found in the specimen of mammectomy (EPOS™ Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

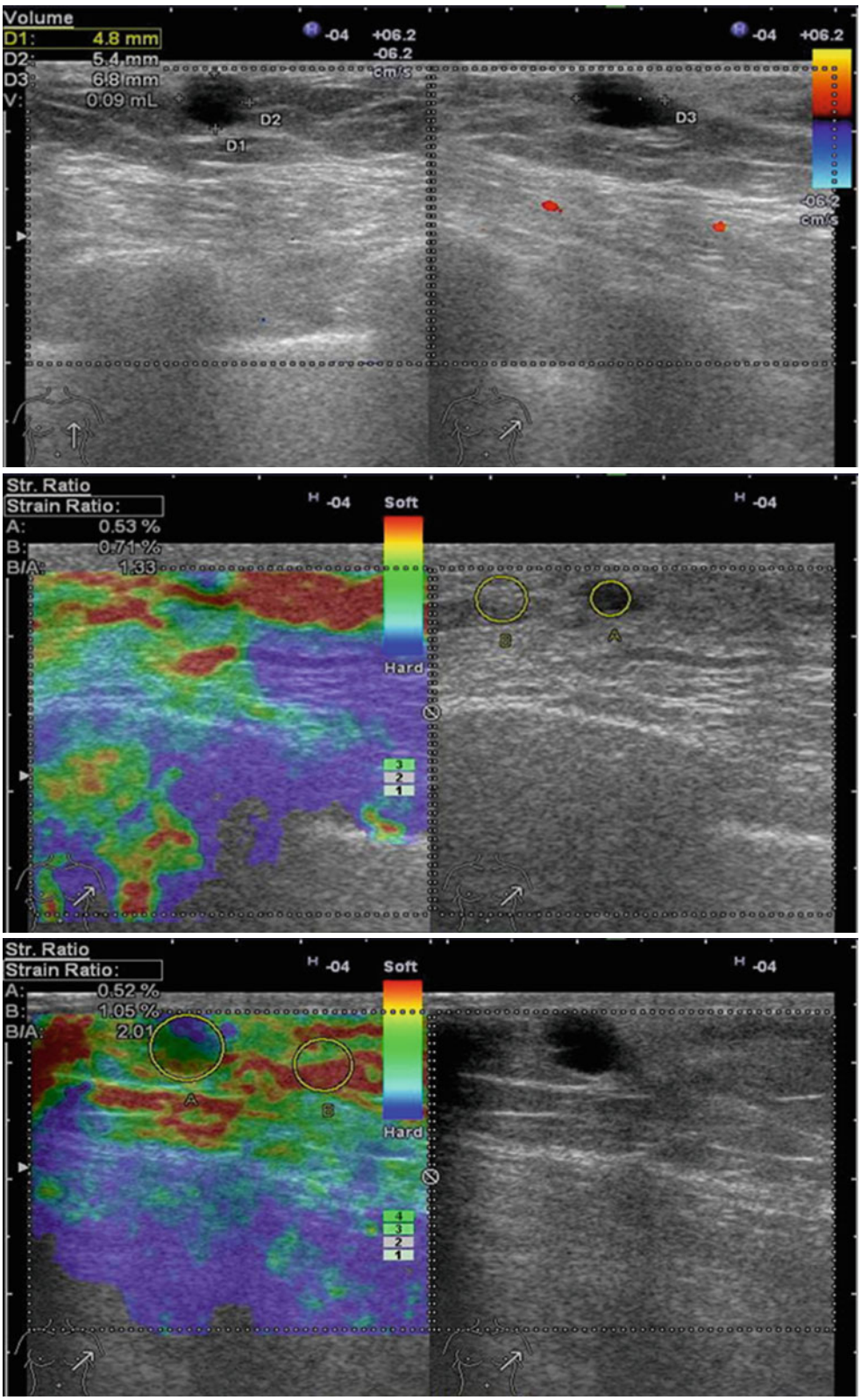


Fig. 9.13 The same case: FBU illustrates suture granulomas with cystic appearances—transonic with irregular borders, without vasculature, and with BGR score of low FLR (EPOS™ Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

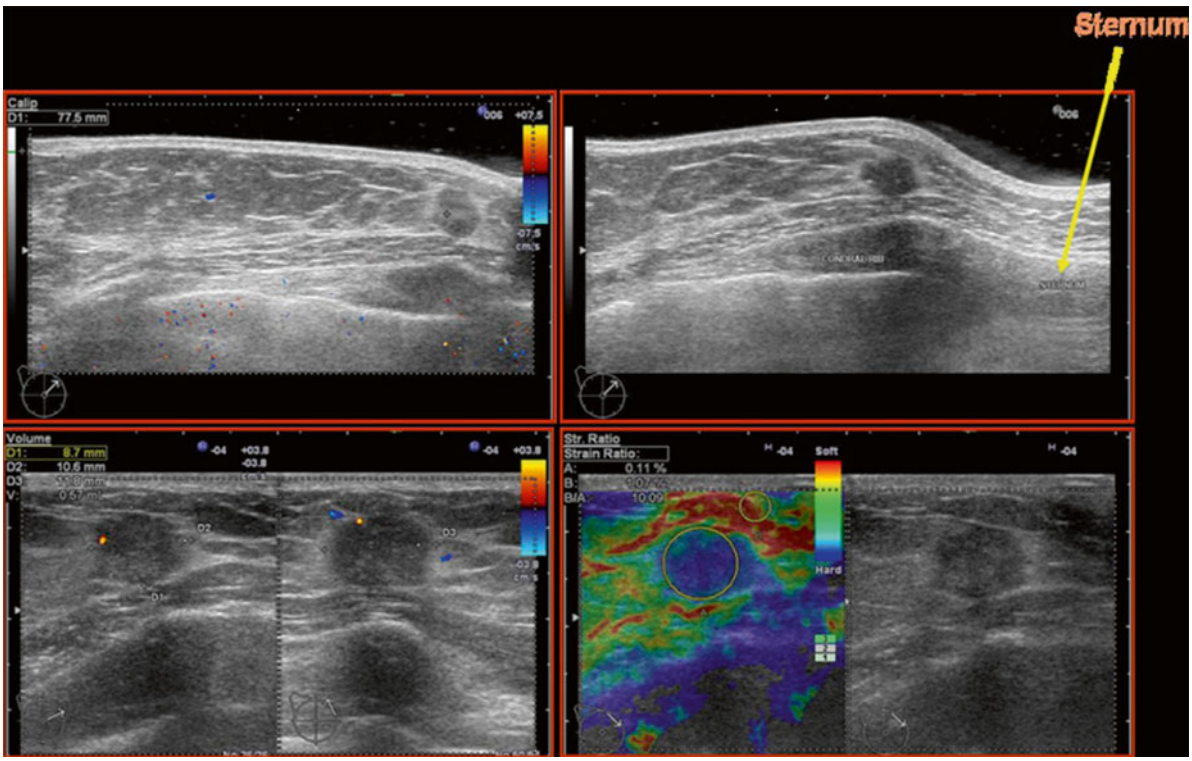


Fig. 9.14 A 64-year-old patient: recent lumpectomy in the right UIQ for palpable lesion, mammographically visible. FBU illustrates remnant parasternal IDC: "recidivate" or missing cancer? (EPOS™ Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

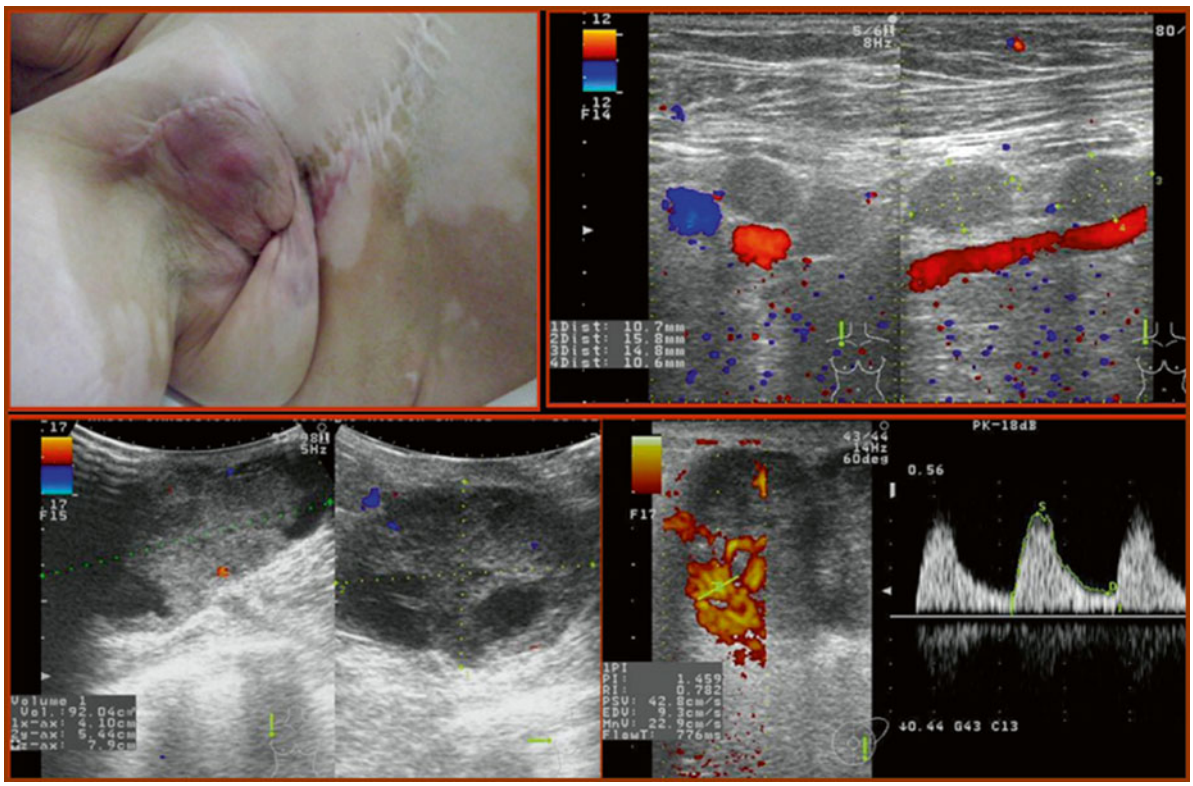


Fig. 9.15 Huge breast tumor in a 56-year-old female treated in other service by tumorectomy without lymphadenectomy; with pathological reports proving malignancy, it was followed by mammectomy with axillary lymphadenectomy and chemotherapy. Actual presentation has secondary axillary recidivism and supraclavicular adenopathy. We have to answer many questions: Why tumorectomy? What was the initial diagnosis? Why incomplete lymphadenectomy and secondary adenopathy? The Doppler US aspect is similar to the findings in malignant cystosarcoma phyllodes that may explain the evolution (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

Fig. 9.16 A 58-year-old patient: huge breast malignant tumor with malignant cytology both in mammary and axillary lymph node aspirates; follow-up after preoperative chemotherapy (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

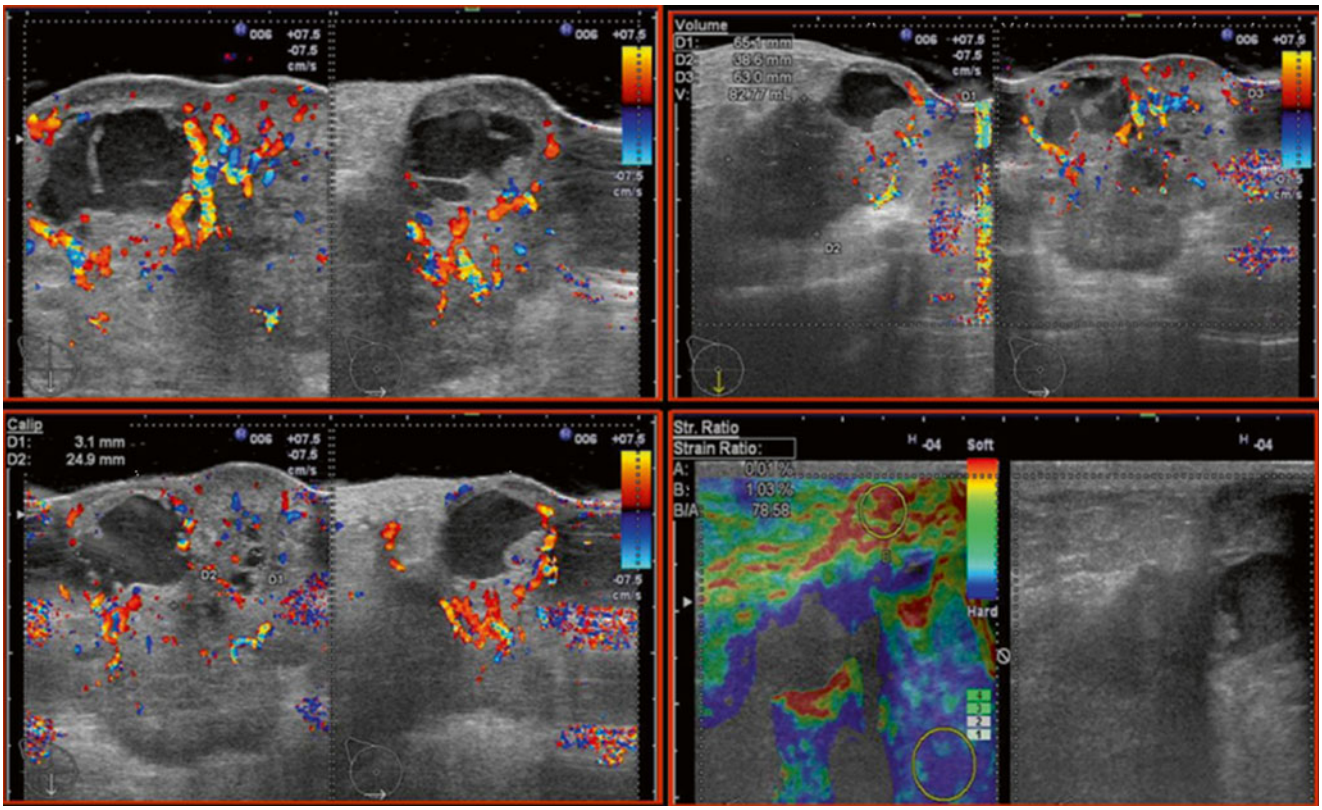


Fig. 9.17 The same case, FBU aspect: huge breast tumor with solid and cystic areas, malignant-type vasculature, and high FLR. Malignant cystosarcoma phyllodes was suspected (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

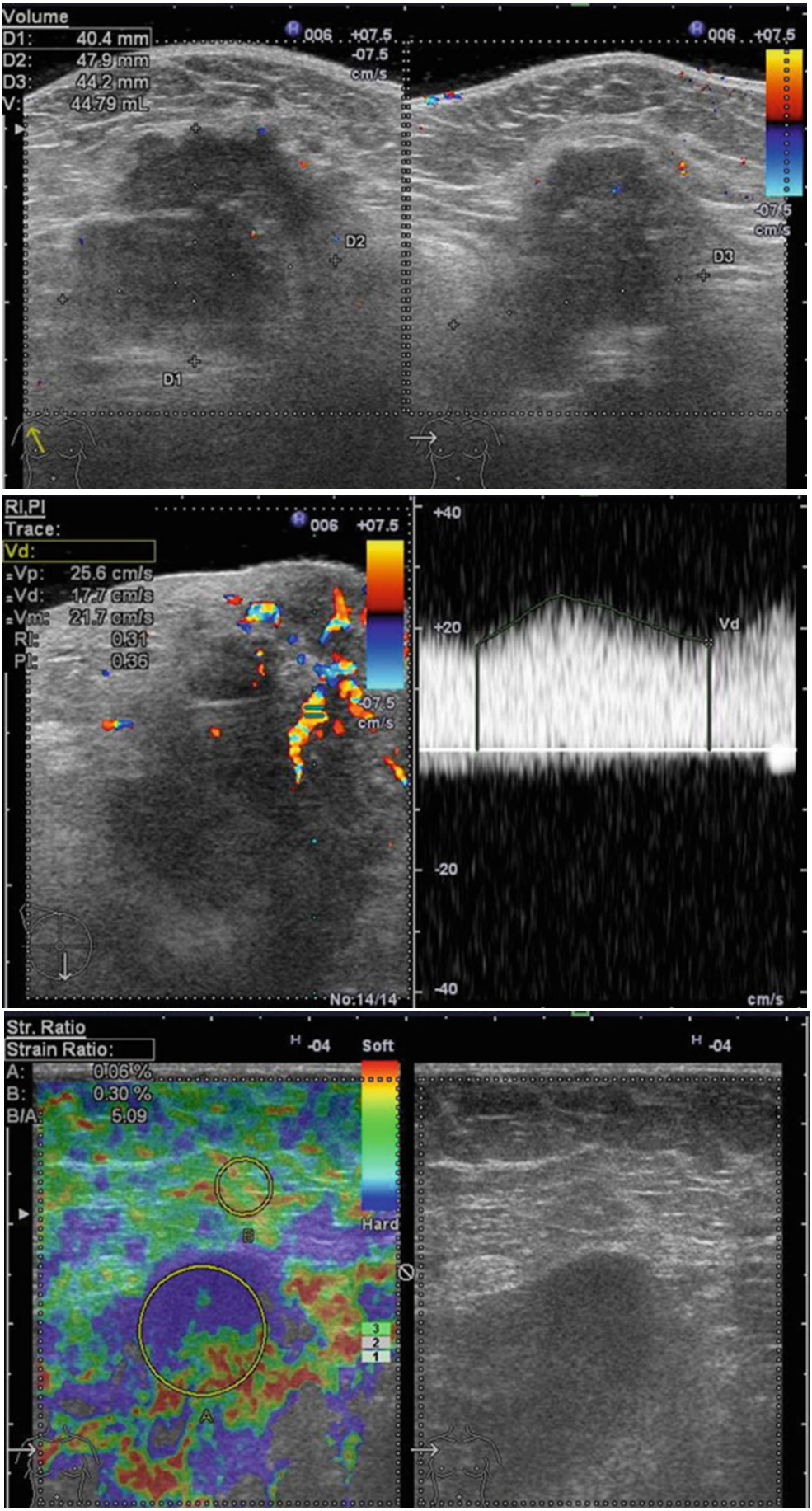


Fig. 9.18 The same case: axillary metastatic lymph nodes with similar internal structure, low-resistance blood flow indices, and BGR score of moderate increased FLR up to 5.09 ("true benign" BGR is usually less than 2.50). Malignant cystosarcoma phyllodes was confirmed (EPOS™ Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

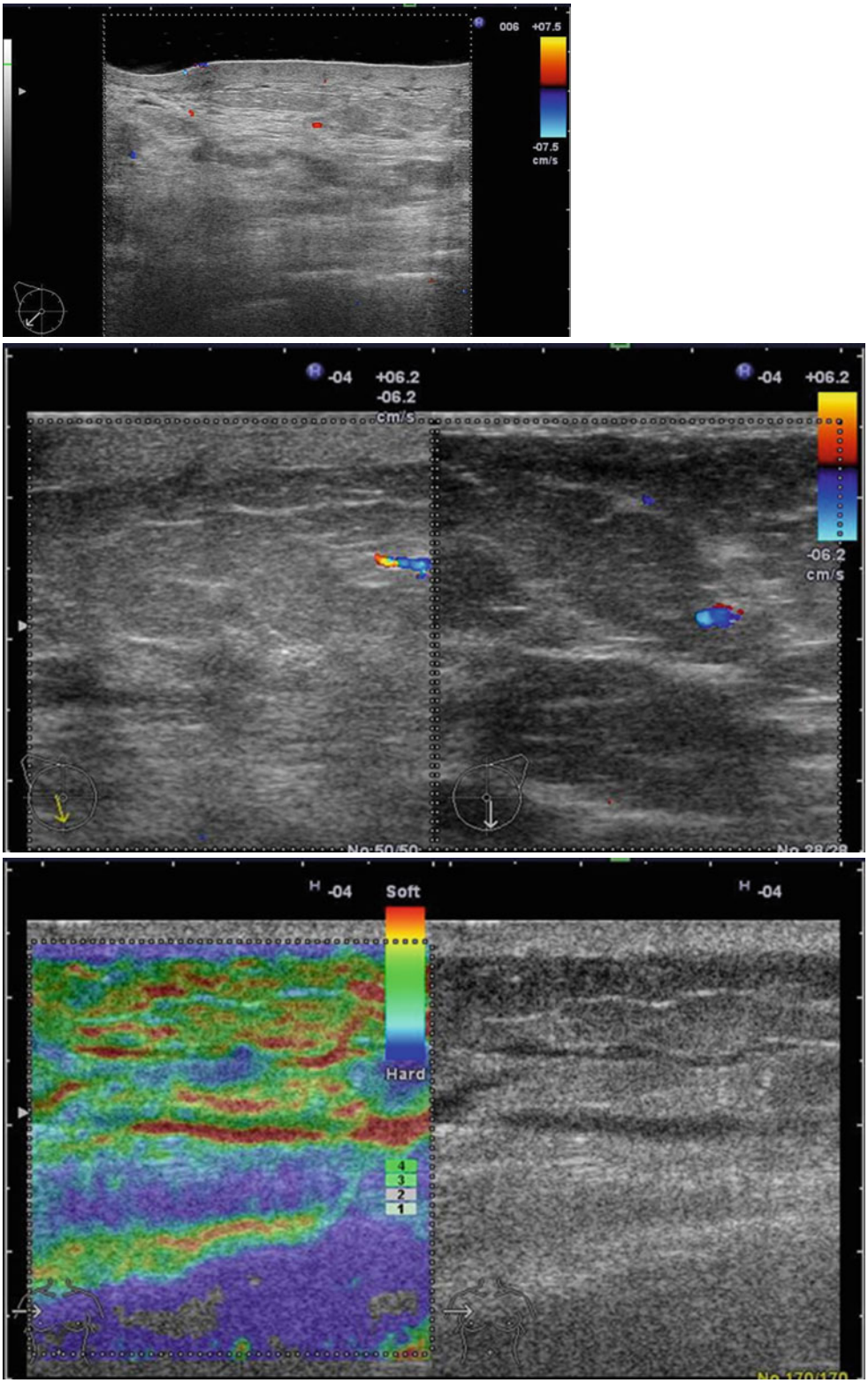


Fig. 9.19 The same case: malignant-type lymphedema in the breast outside the tumor, due to the axillary lymph node involvement; note the salient diffuse vasculature and the relative increased hardness at sonoelastography of the glandular layers as compared with the premammary fatty tissue (EPOS™ Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

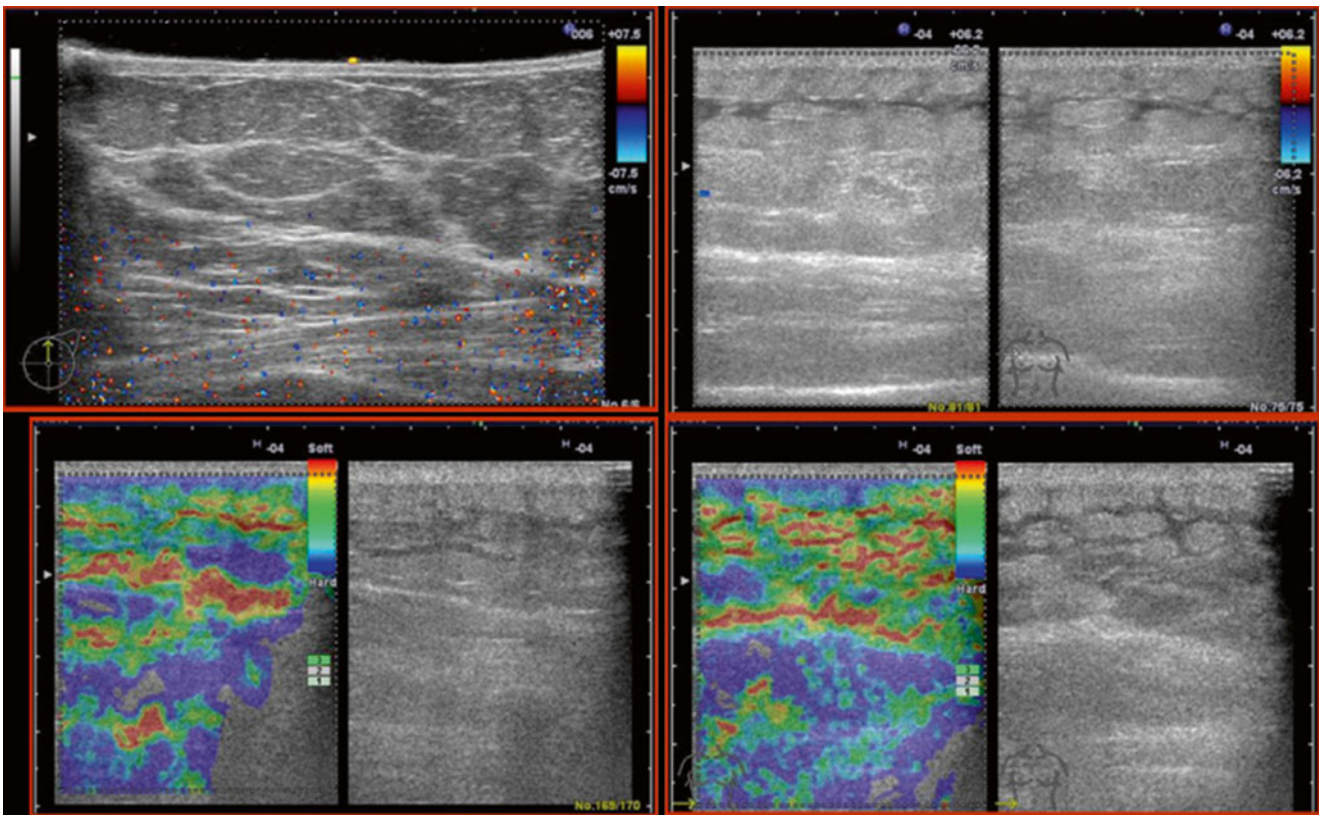


Fig. 9.20 A 58-year-old patient: fatty breast on the left side and benign lymphedema of the right breast postsurgical treatment and radiotherapy (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

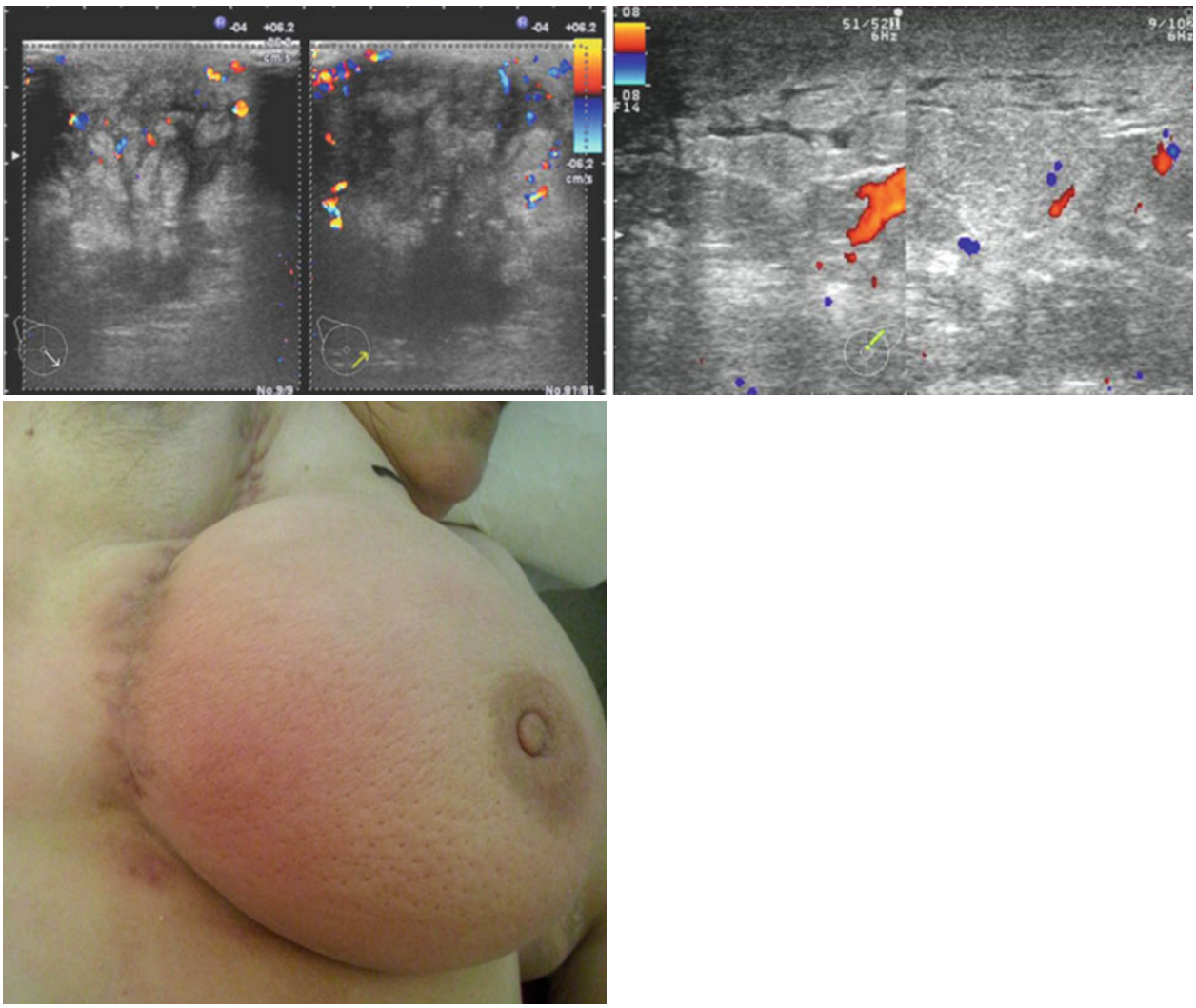


Fig. 9.21 Carcinomatous mastitis: large, irregular lymphatic spaces with significant new vasculature and acoustic shadowing (*left*) as compared with benign lymphedema, parallel to the skin lymphatics, with diffuse hyperechogenicity, and with moderate Doppler signal (*right*) (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

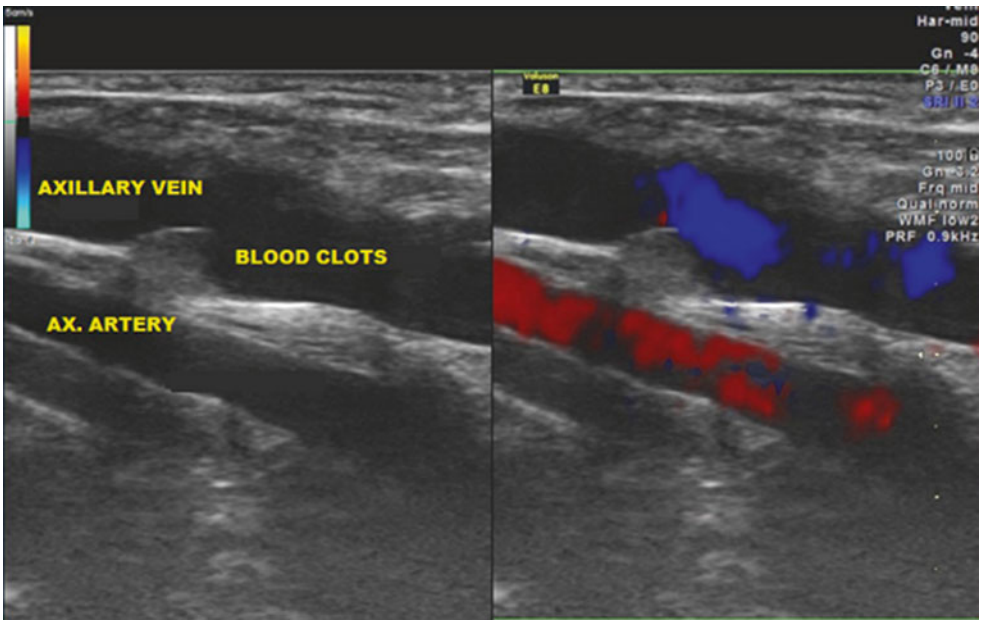


Fig. 9.22 Postsurgical upper limb edema and partial thrombosis of the axillary vein: the initial/starting location near the venous valves (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

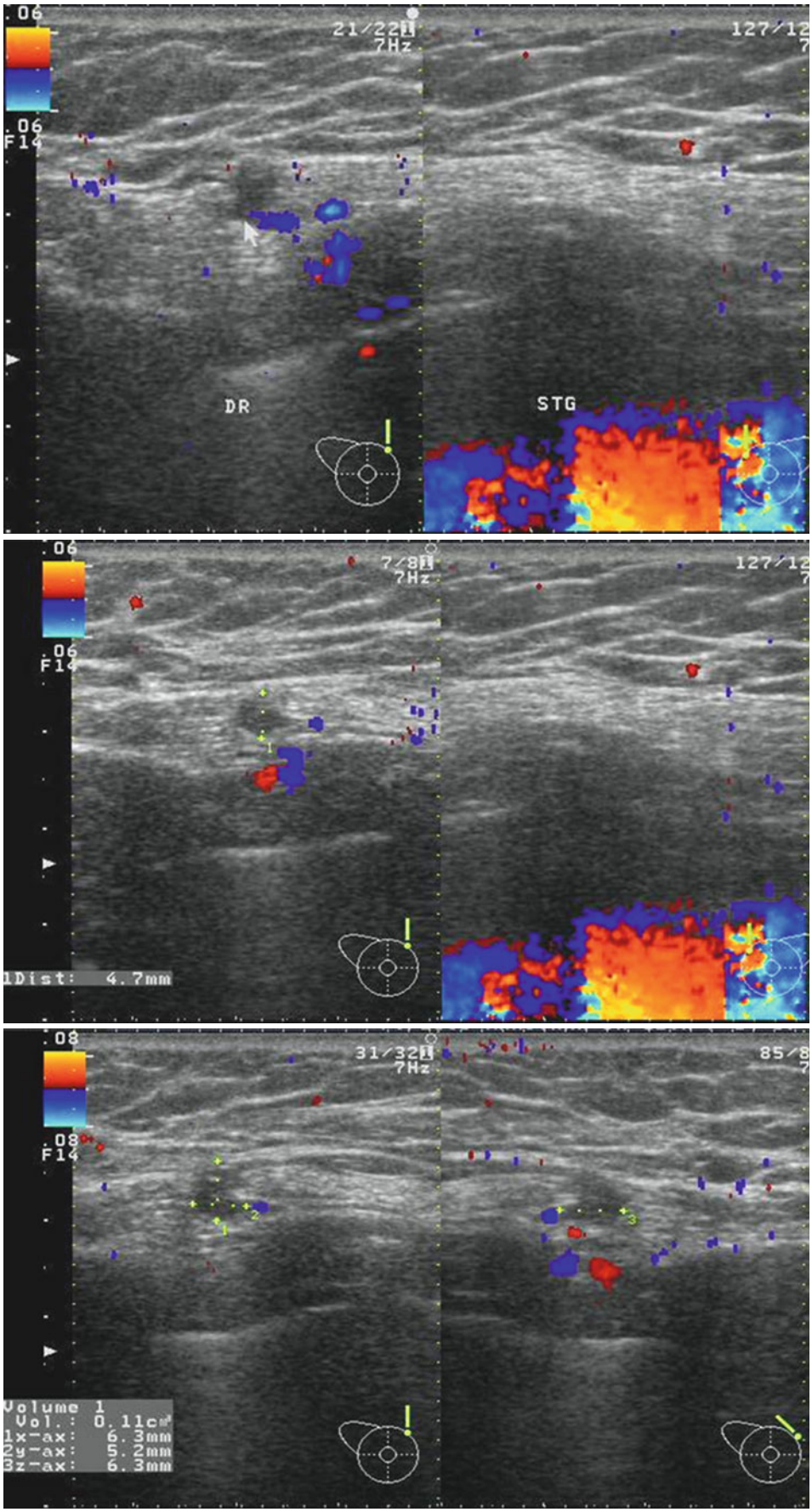


Fig. 9.23 Local recurrent carcinoma in the upper-inner quadrant, located in the parasternal pectoral muscle; the aspect is easy to confirm when compared with the contralateral region, and the malignancy is better characterized by the new vasculature with deep connections

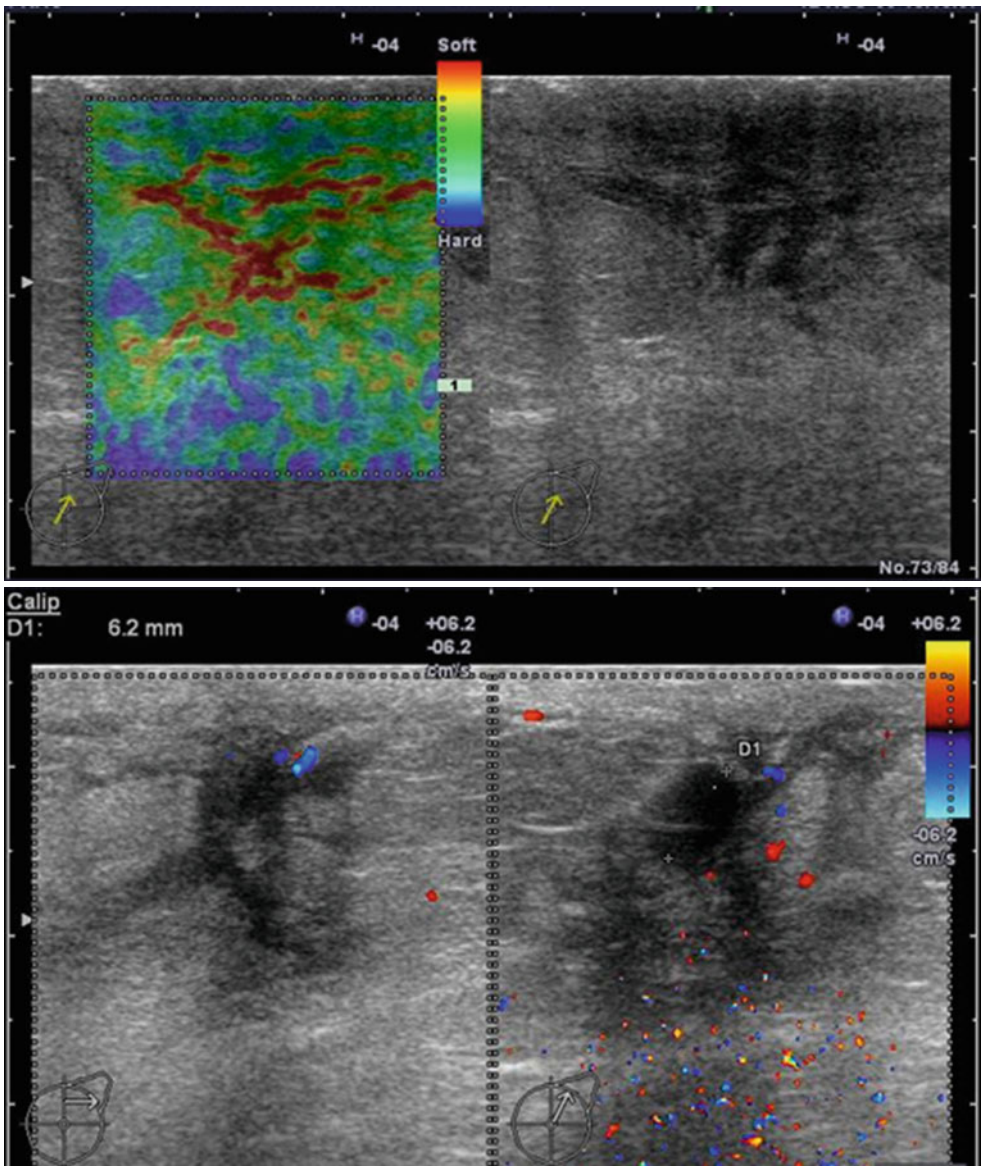
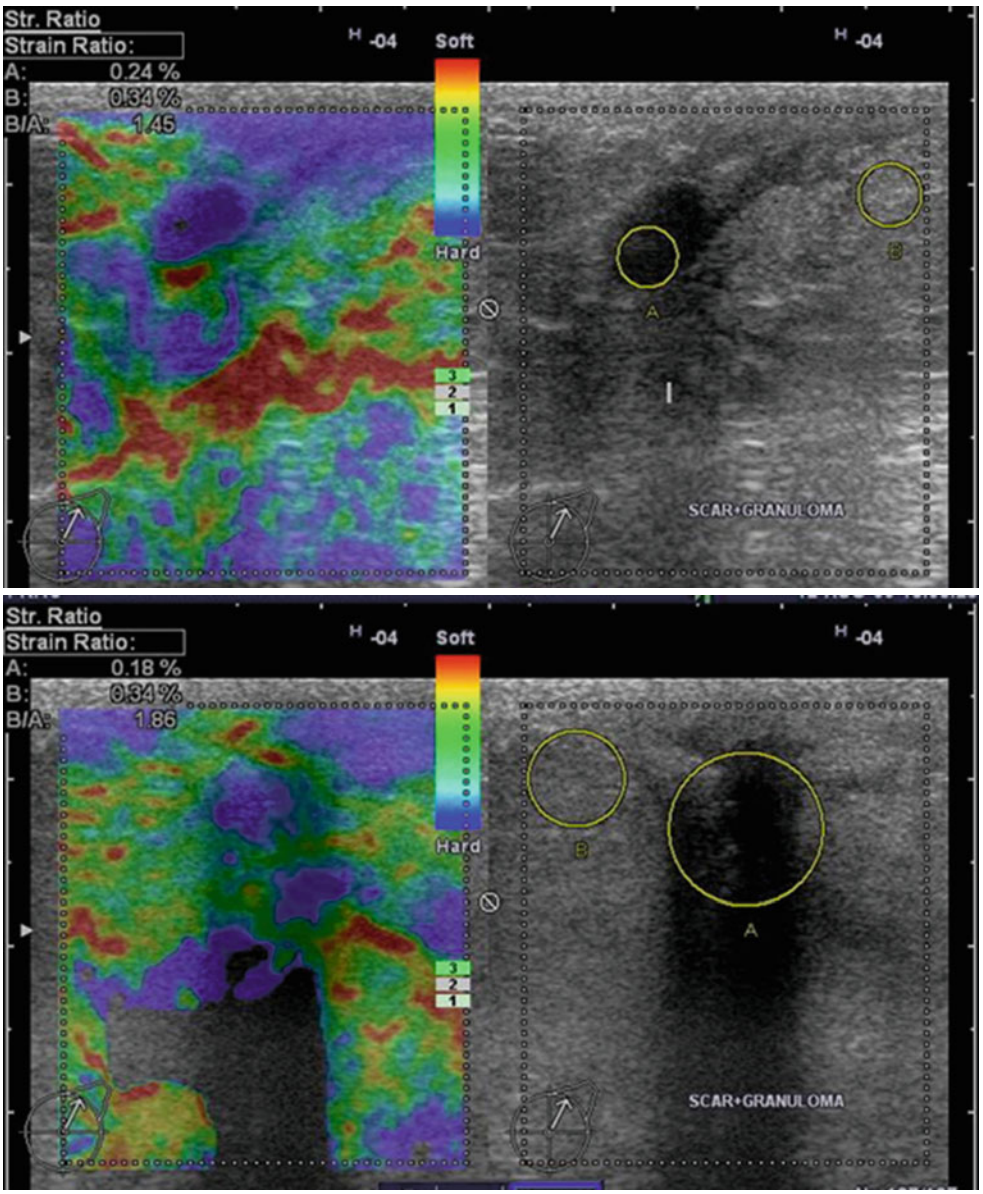


Fig. 9.24 A 62-year-old patient: retroareolar lymphedema (upper), benign scar, and granuloma, better differentiated from malignancy with FBU, despite the equivoque aspect in 2D US. A short-term follow-up is recommended

Fig. 9.24 (continued)



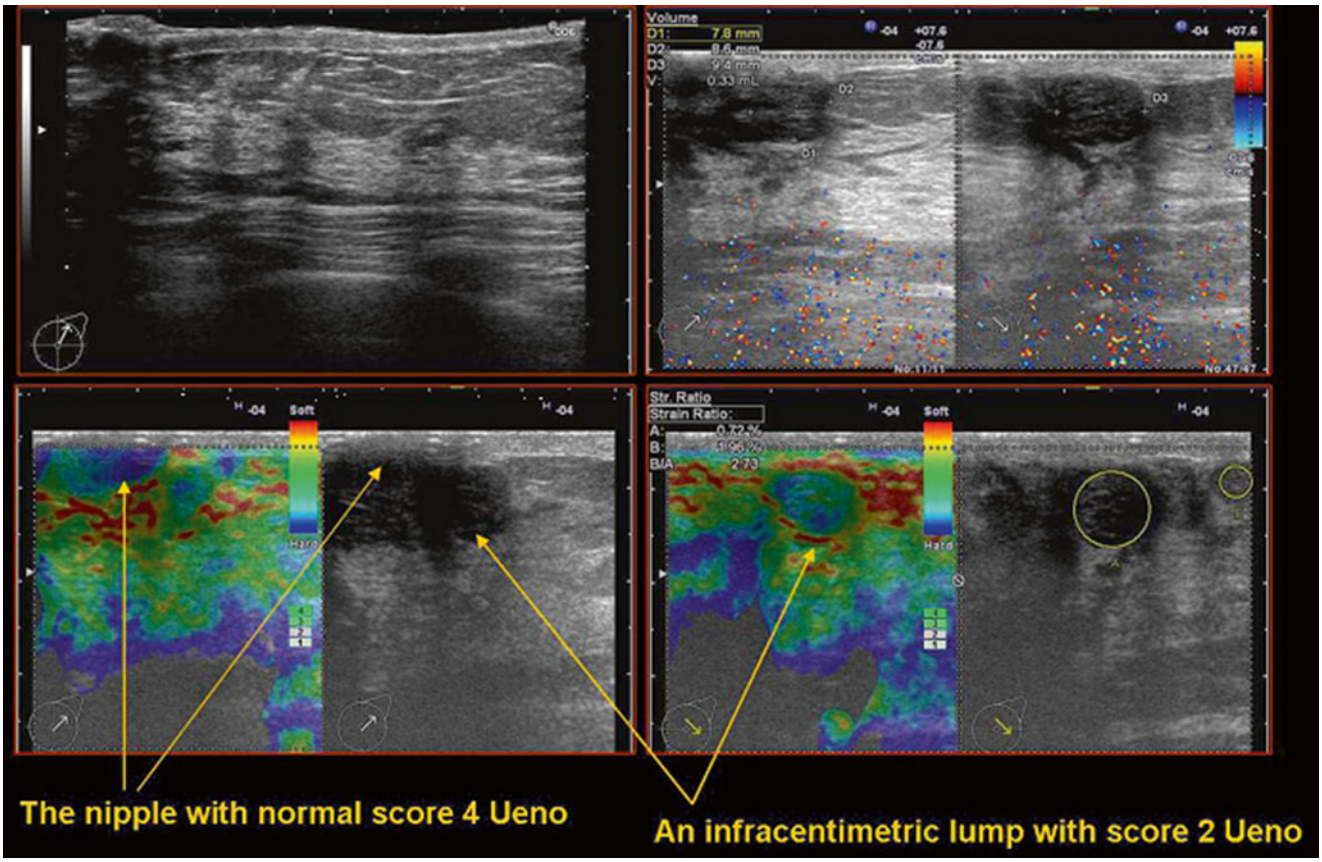


Fig. 9.25 A 44-year-old patient with remnant periareolary tumor: FBU illustrates a "solid", benign-type tumor (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

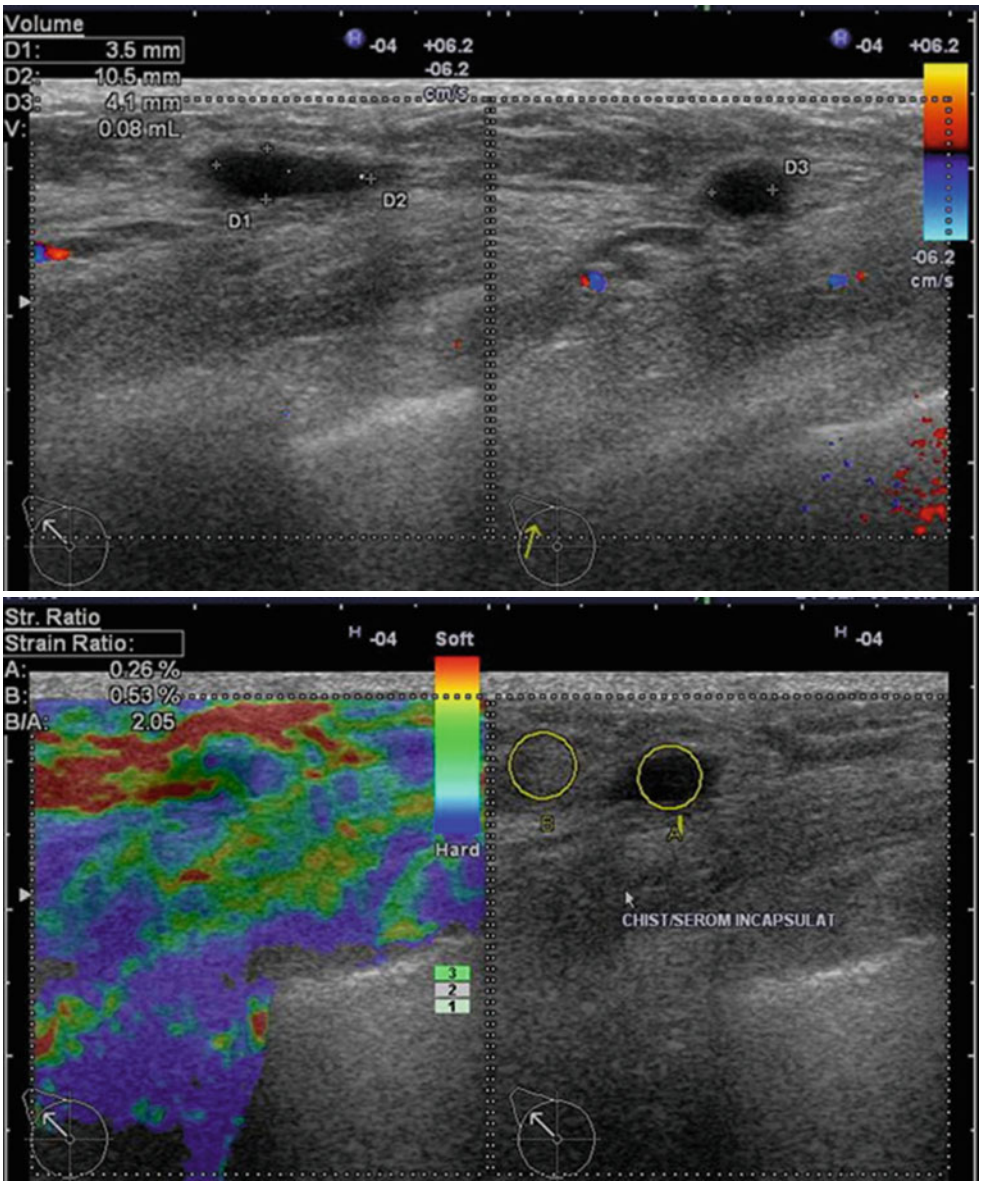


Fig. 9.26 A 35-year-old patient: residual seroma 14 months postmammectomy, with BGR score in sonoelastography; the thickened wall is secondary to the radiotherapy and long-term evolution

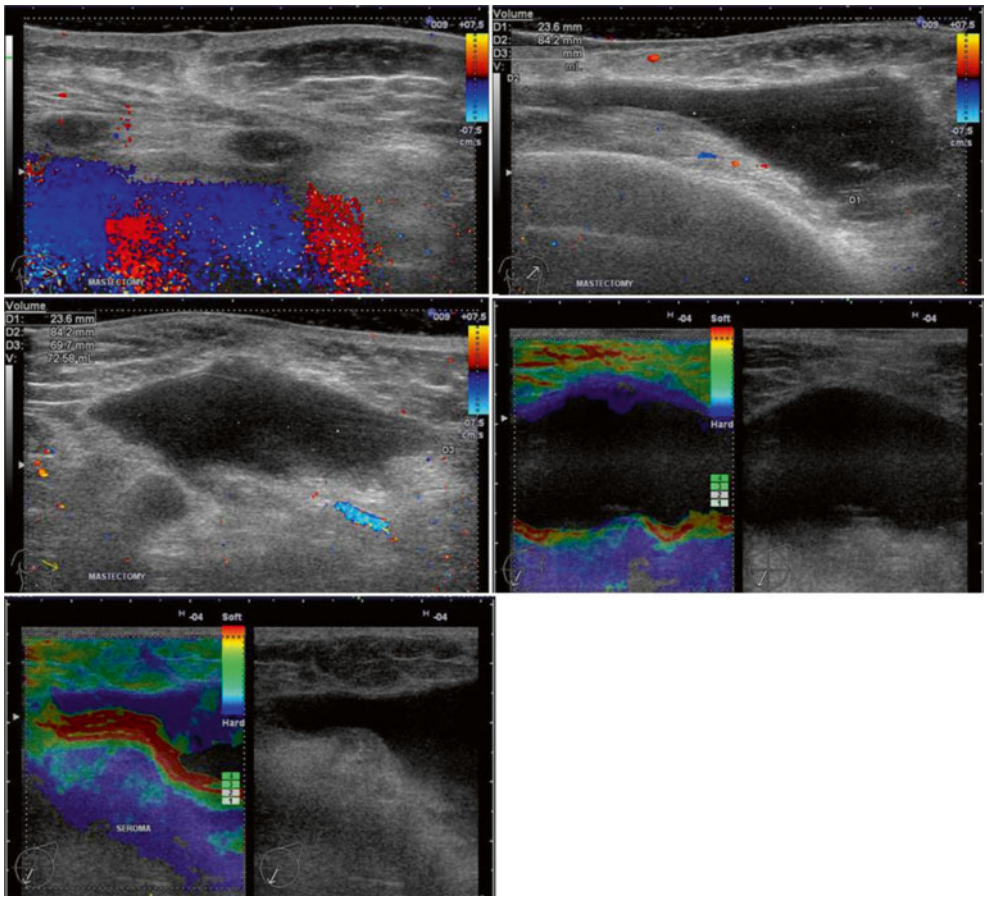


Fig. 9.27 A 48-year-old patient: large seroma post left breast conservative surgery, on radial and antiradial scans with a water-bag 9 cm length transducer; RTSE with short high-frequency transducer on the central region presents artifact because of the great diameters, but at the periphery demonstrates the typical BGR score for fluids

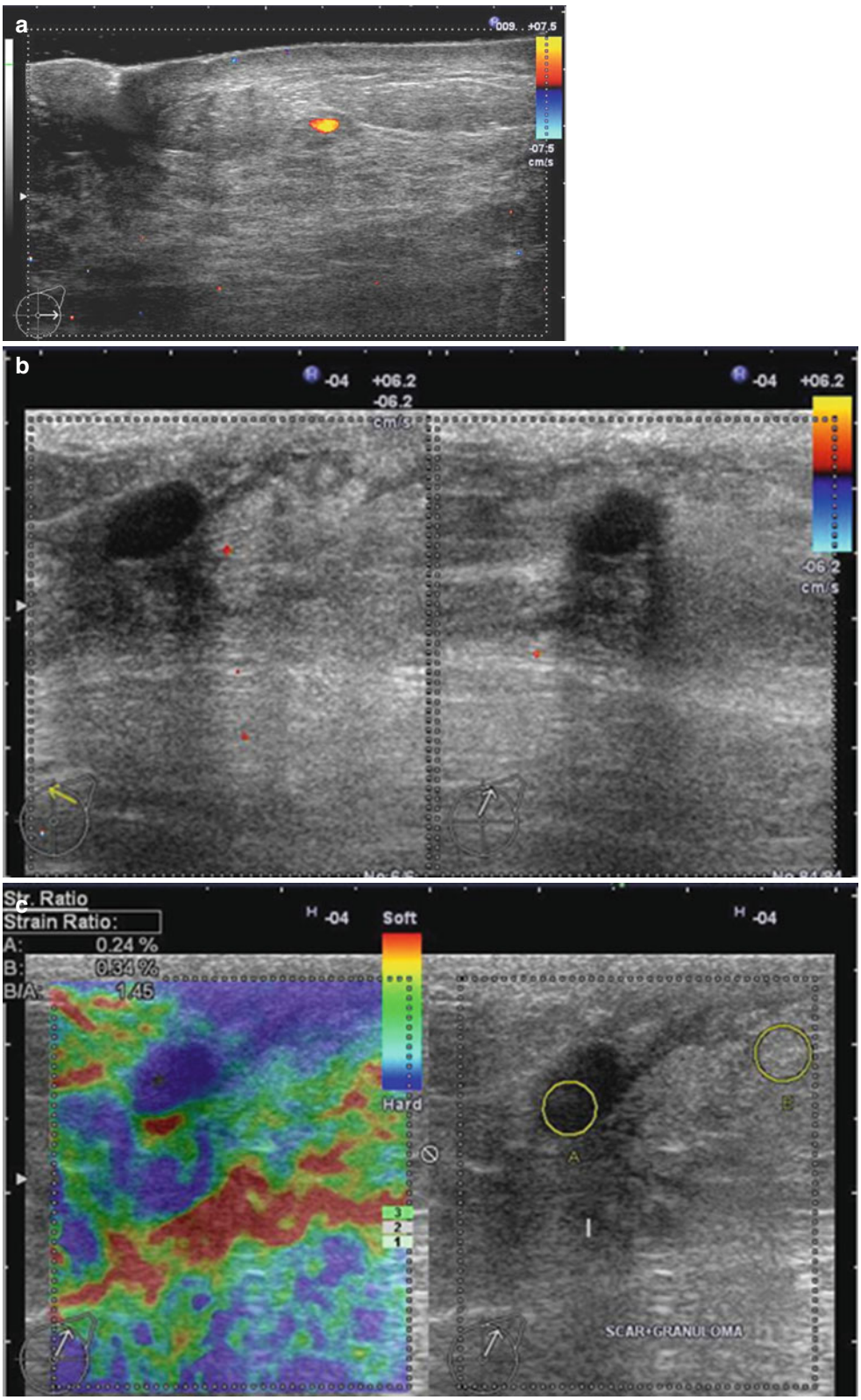


Fig. 9.28 A 62-year-old patient with a scar post conservative surgical treatment of breast cancer in the upper-outer left quadrant, followed by radiotherapy, associated with complex changes: follow-up FBUS illustrates breast edema with skin thickening and hyperechoic premammary fatty tissue (**a**), a cystic lesion in the scar area with BGR score (**b**, **c**), a suspect segment of the scar with classical US features of malignant type (**d**) but presenting a score 3 Ueno with low FLR (1.86) and retroareolar edema (**e**)

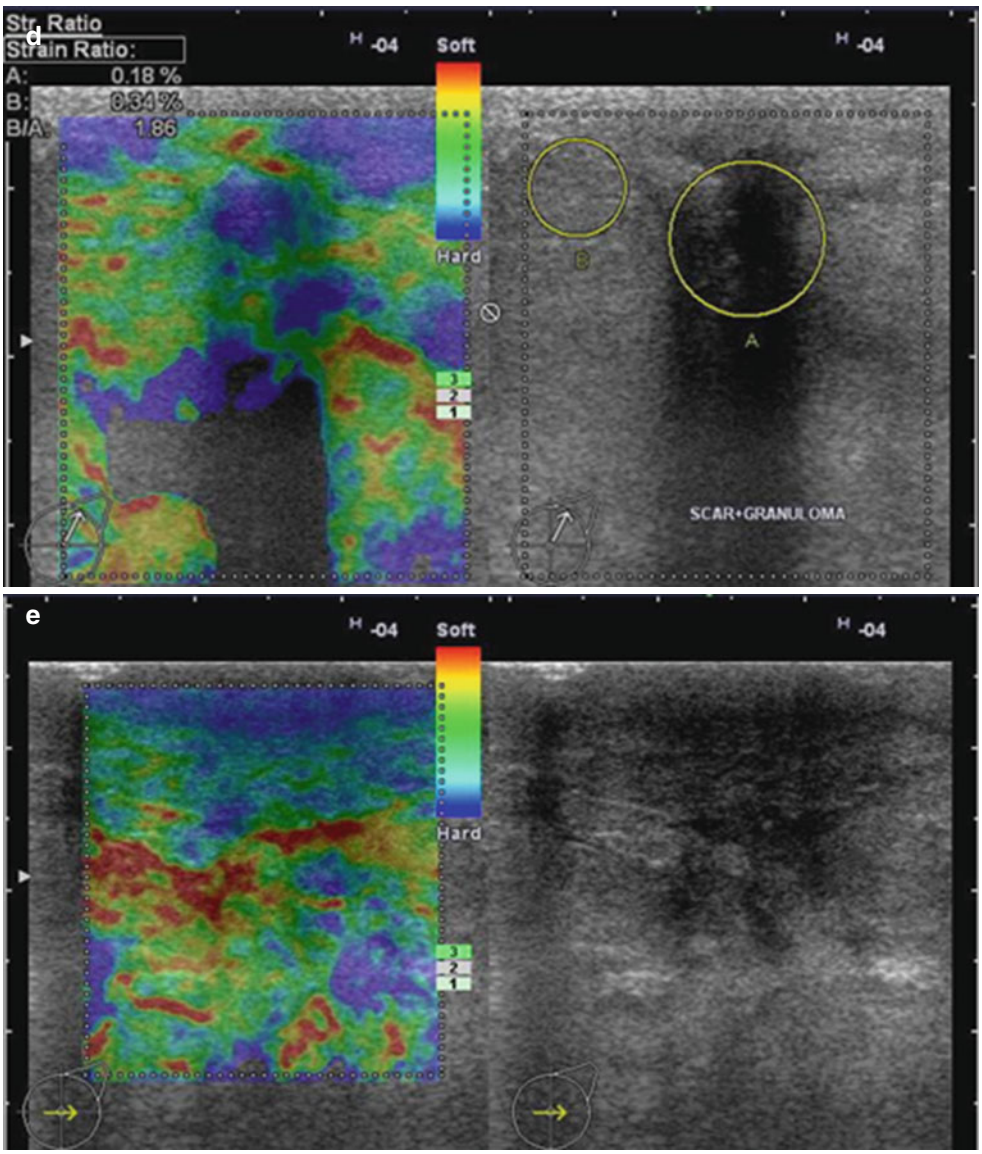


Fig. 9.28 (continued)

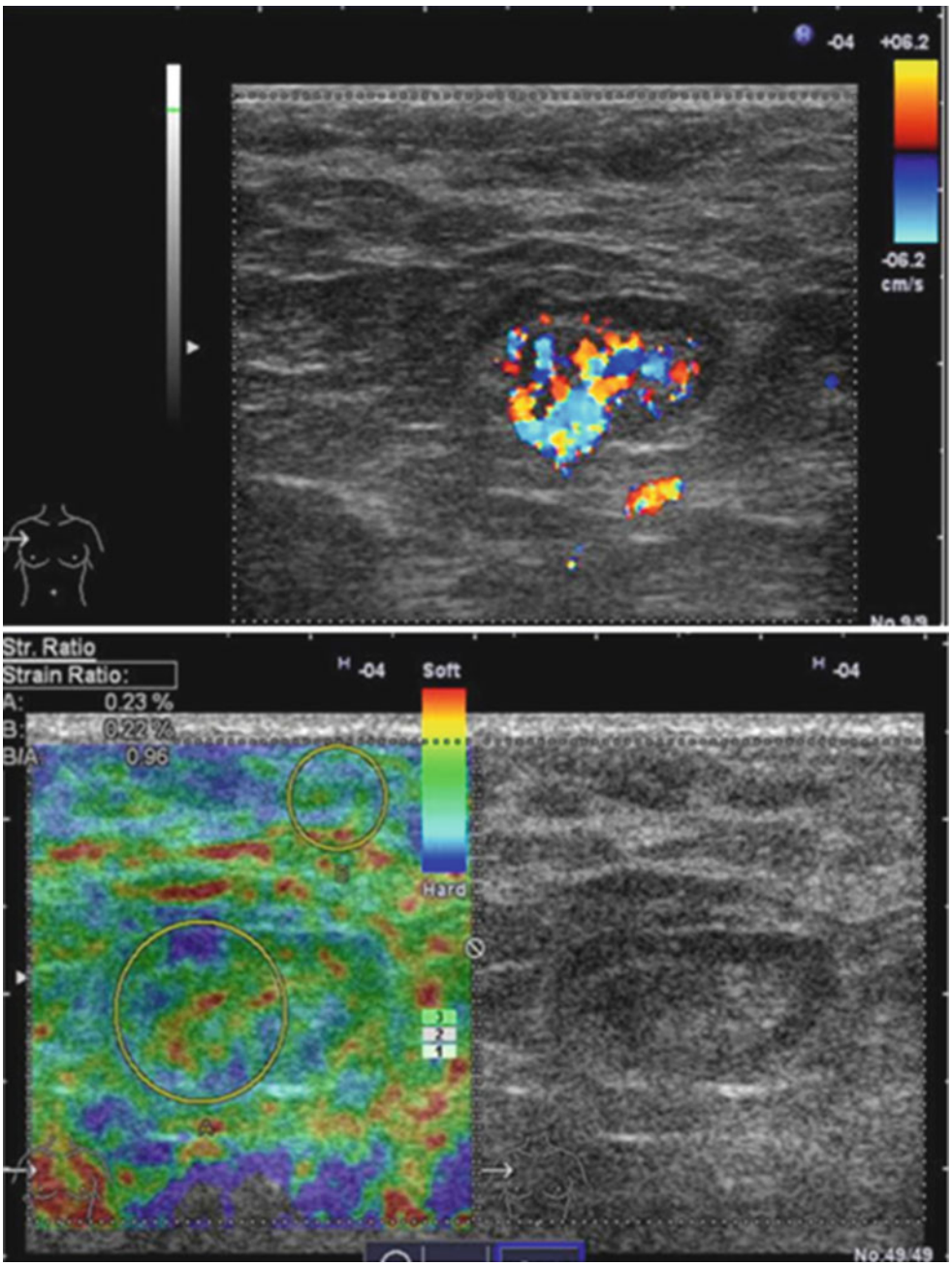
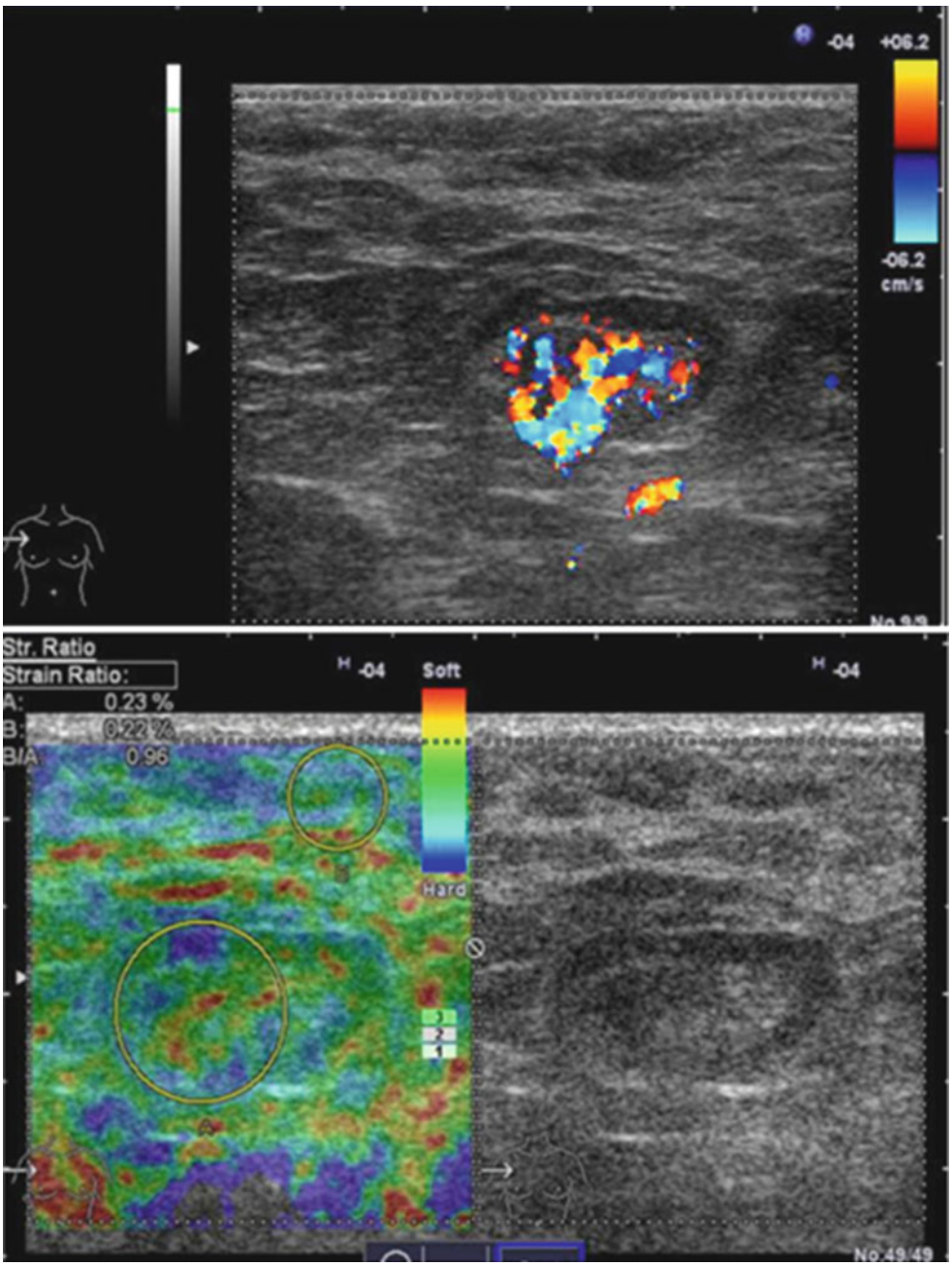


Fig. 9.29 FBU in benign-type remnant lymph nodes: when the vasculature is increased in the sinus, without cortical changes, an acute inflammation is present, while a hypoechoic aspect of the central part of the sinus is correlated with benign histiocytosis in chronic lymphadenitis (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

Fig. 9.29 (continued)



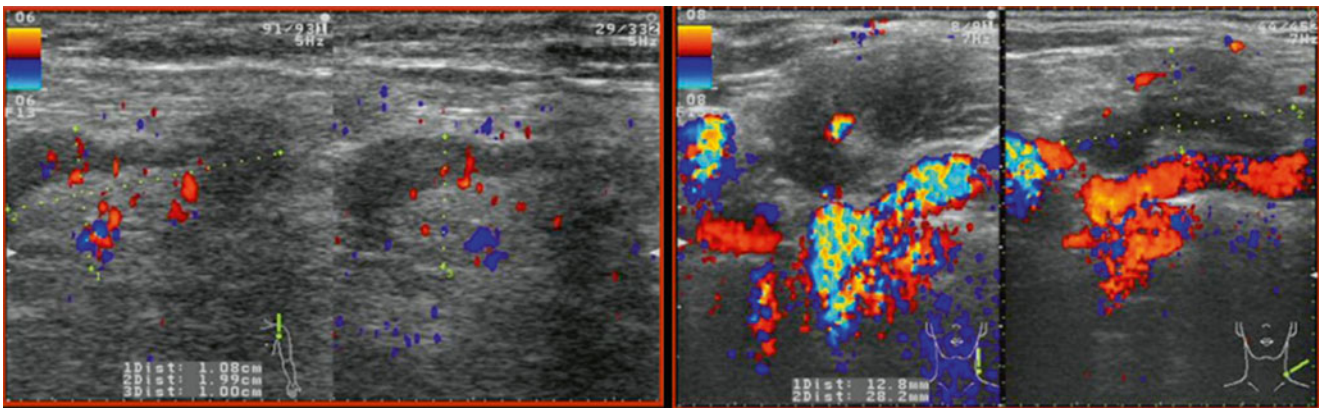


Fig. 9.30 A 38-year-old patient: remnant axillary borderline lymph nodes with increased cortical thickness and focal cortical new vasculature; more salient changes in the supraclavicular nodes (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

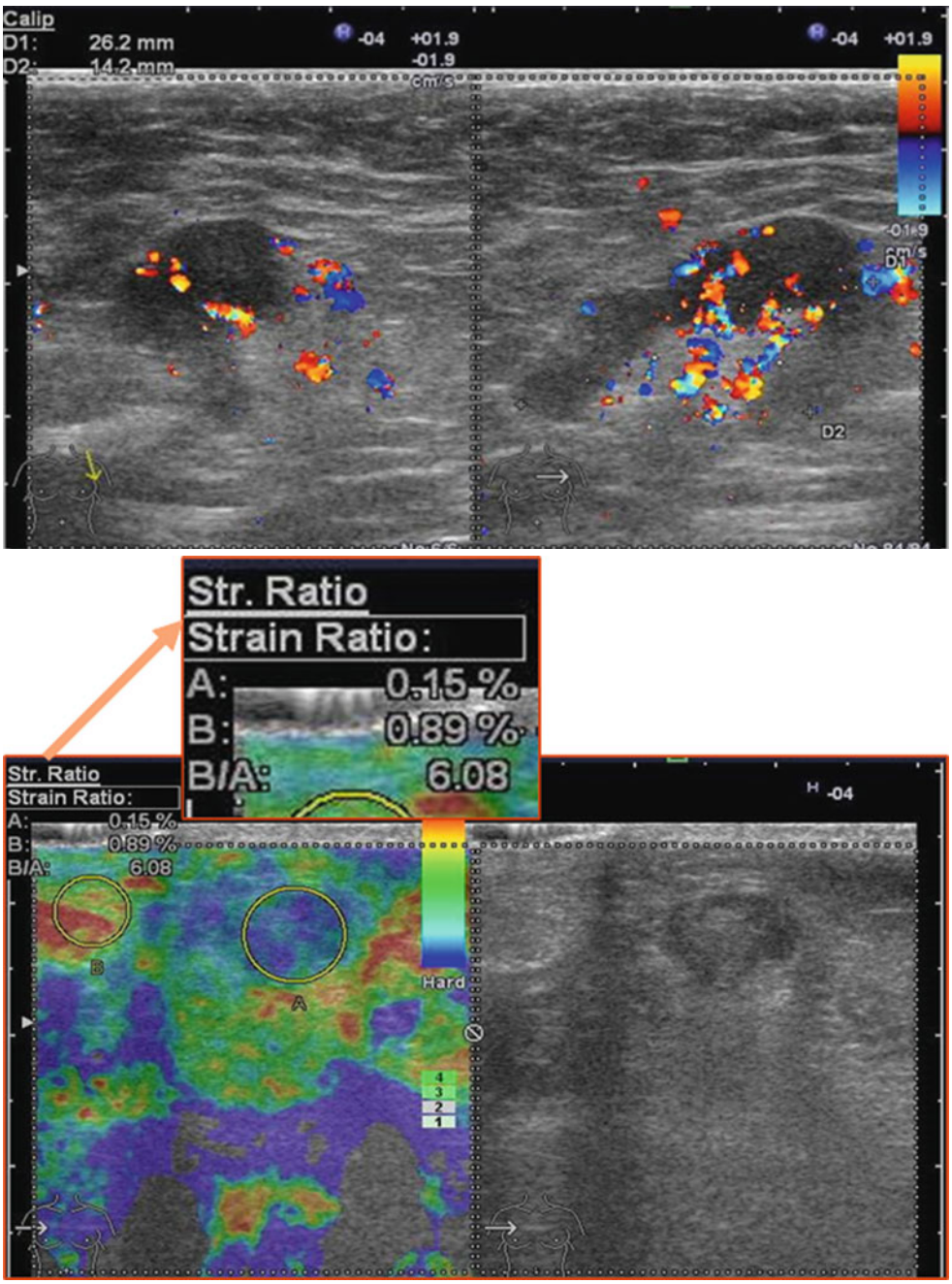


Fig. 9.31 A 65-year-old patient: remnant malignant lymph node after 6 months (radical mammectomy followed by chemotherapy); the excised nodes were normal. The late salient node metastasis had full resolution after supplementary radiotherapy (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

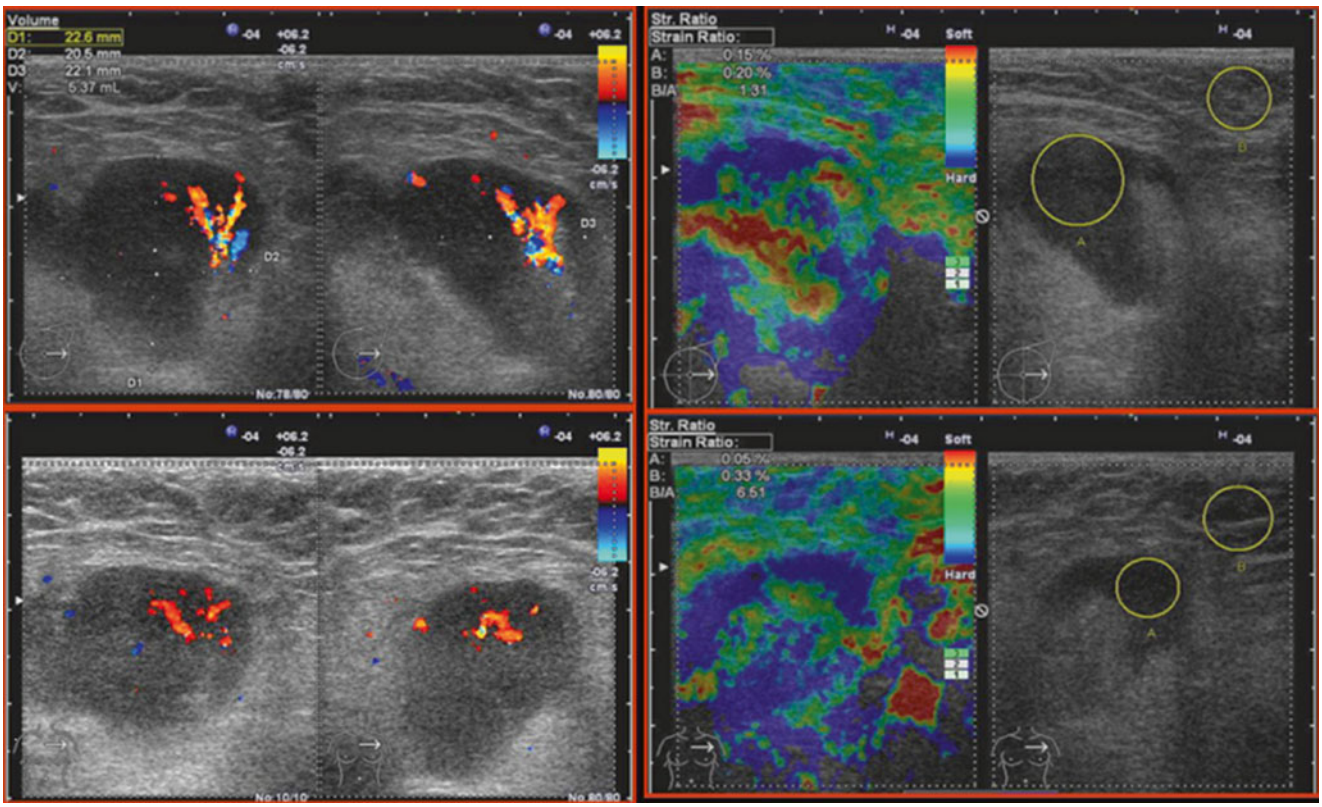


Fig. 9.32 A 64-year-old patient: remnant malignant lymph node with necrosis, complex BGR score, but high FLR; lymph nodes necrosis may be frequently present after chemotherapy or after previous biopsy (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

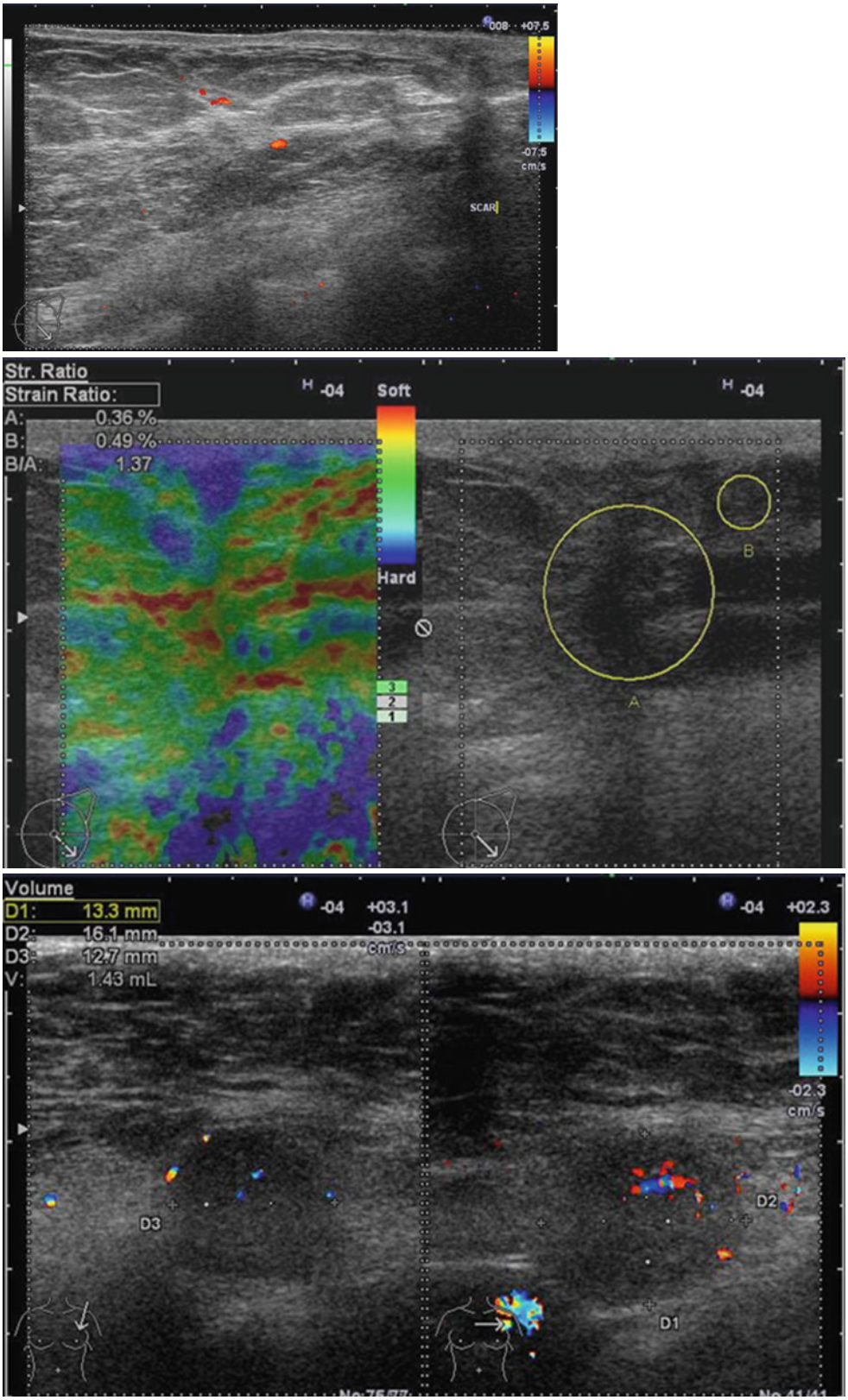
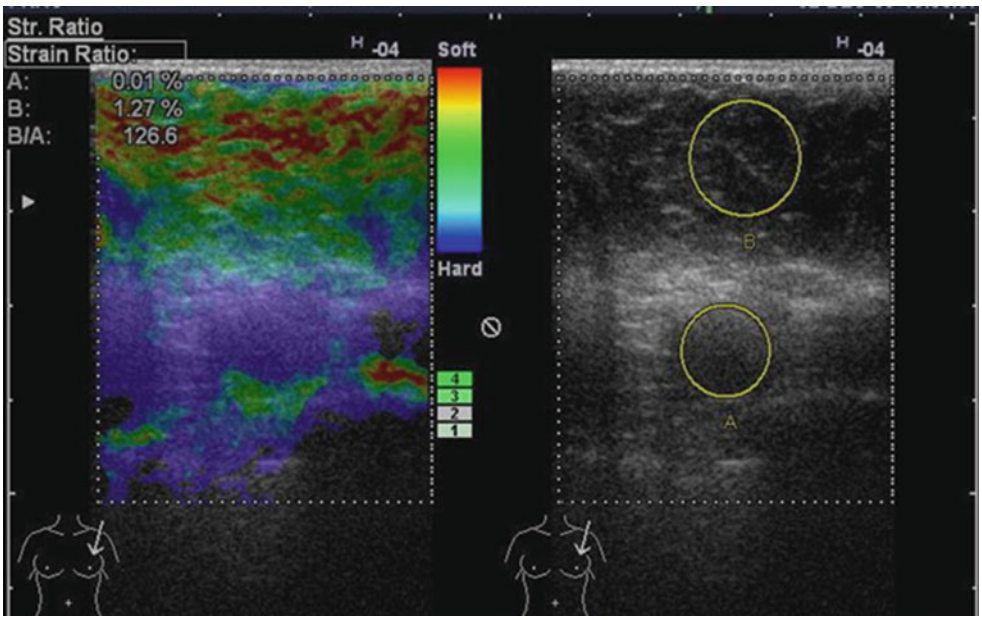
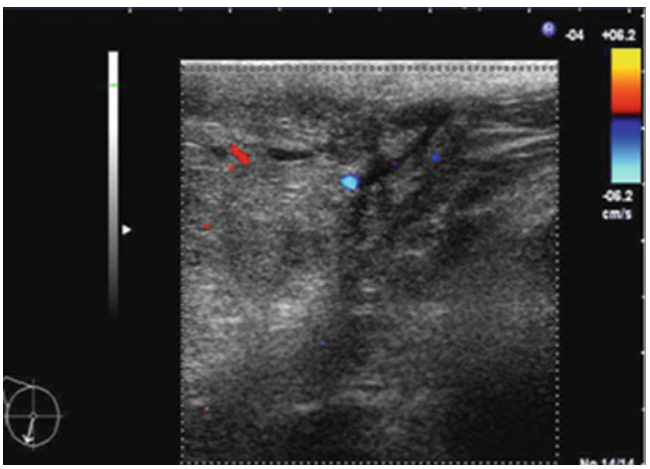


Fig. 9.33 A 66-year-old patient with bilateral medullary breast carcinoma; conservative surgical treatment in the left breast 2 years ago, with follow-up FBU that illustrates benign breast scar, but with a remnant axillary lymph node, with loss of architecture, new vasculature, and score 4 Ueno with high FLR of 126.6, concordant with the contrast CT findings (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

Fig. 9.33 (continued)





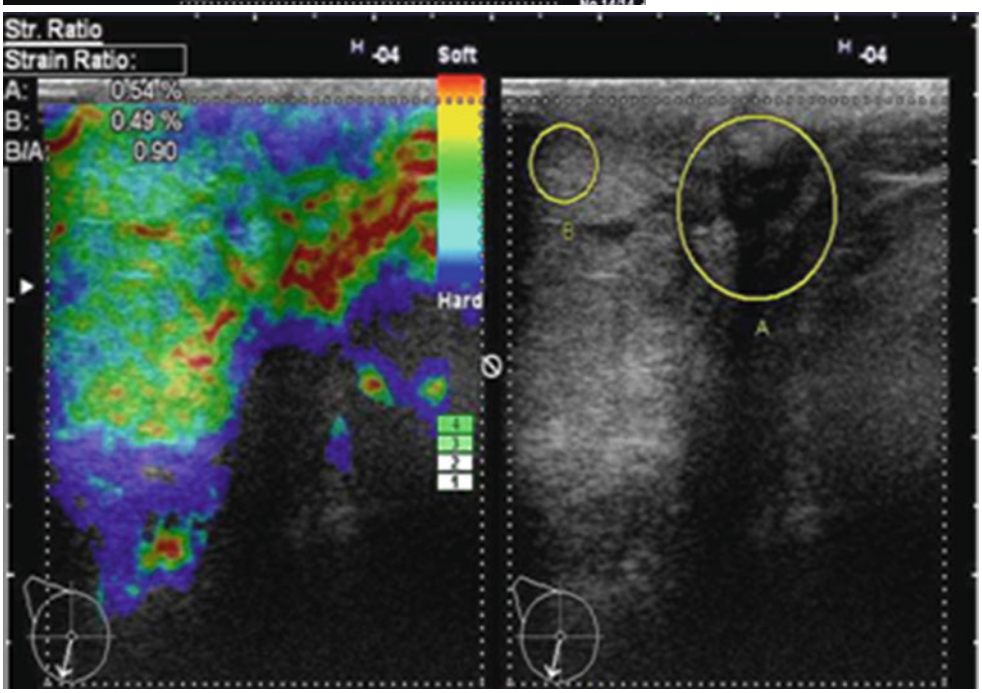
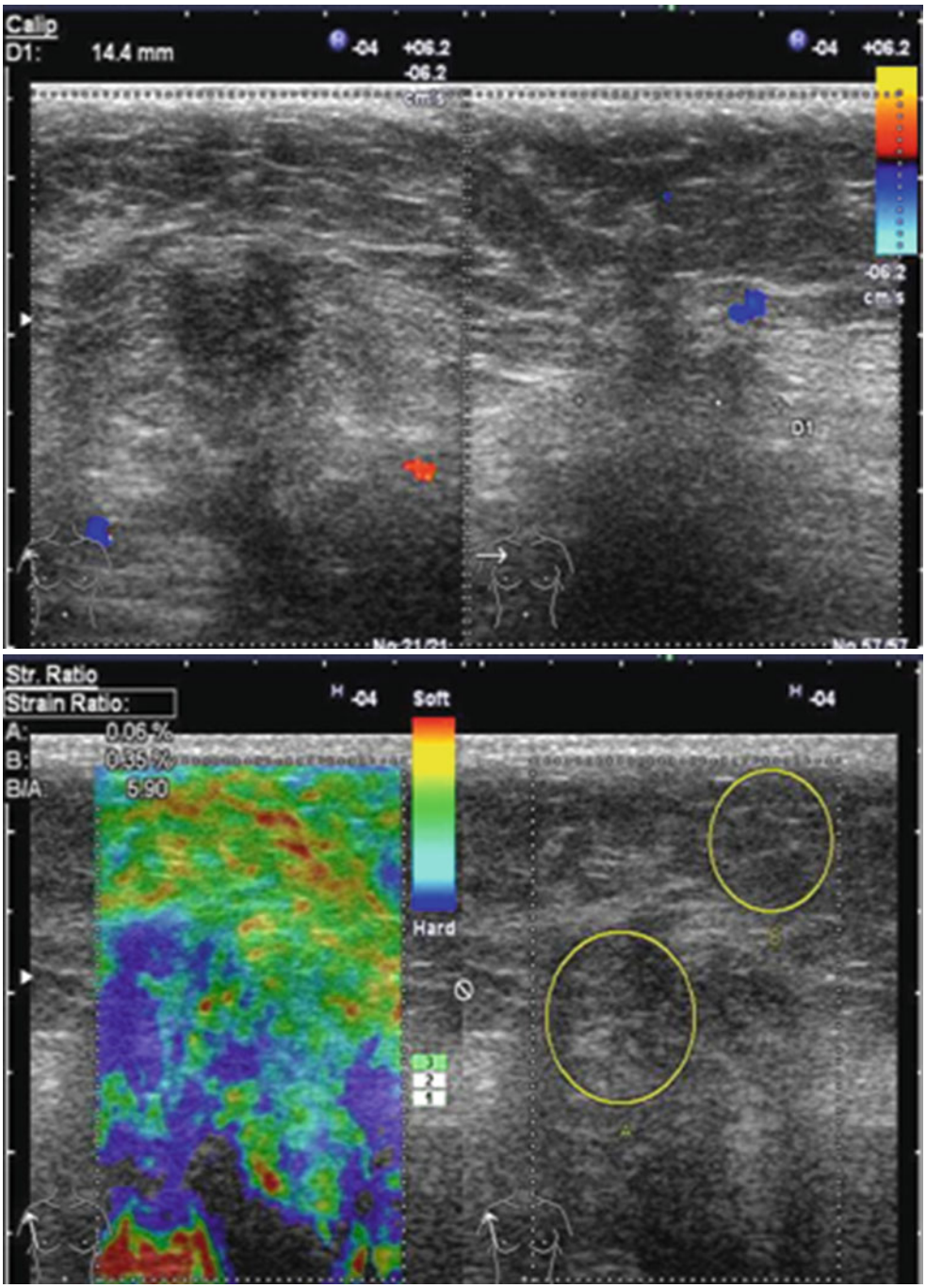


Fig. 9.34 A 66-year-old patient, the same case: conservative surgical treatment 10 months ago in the right breast; FBU presents benign aspect both of the breast scar (*upper* scans) and of the hypertrophic axillary scar (*bottom*)

Fig. 9.34 (continued)



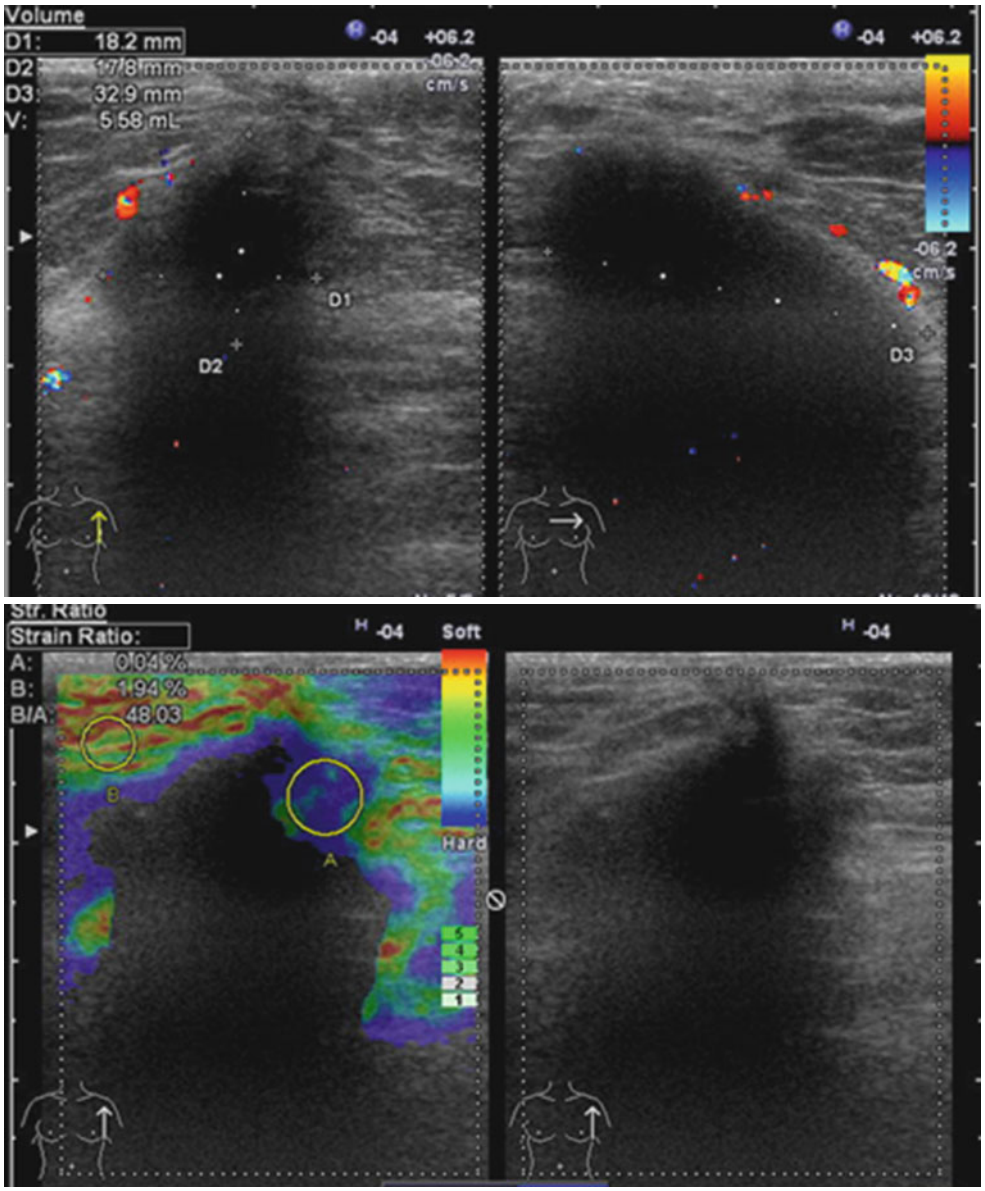


Fig. 9.35 A 62-year-old patient: pseudotumoral mass represented by chronic remnant fluid collection insufficiently drained after the surgical treatment, located under the axillary scar, presents a hard, fibrous contour, mimicking malignancy on US and RTSE, but without any internal Doppler signal; multiplanar reconstructions CT present even in the native acquisitions the hyperdense wall and the fluid density in the center of the left axillary lesion (*white arrow*)

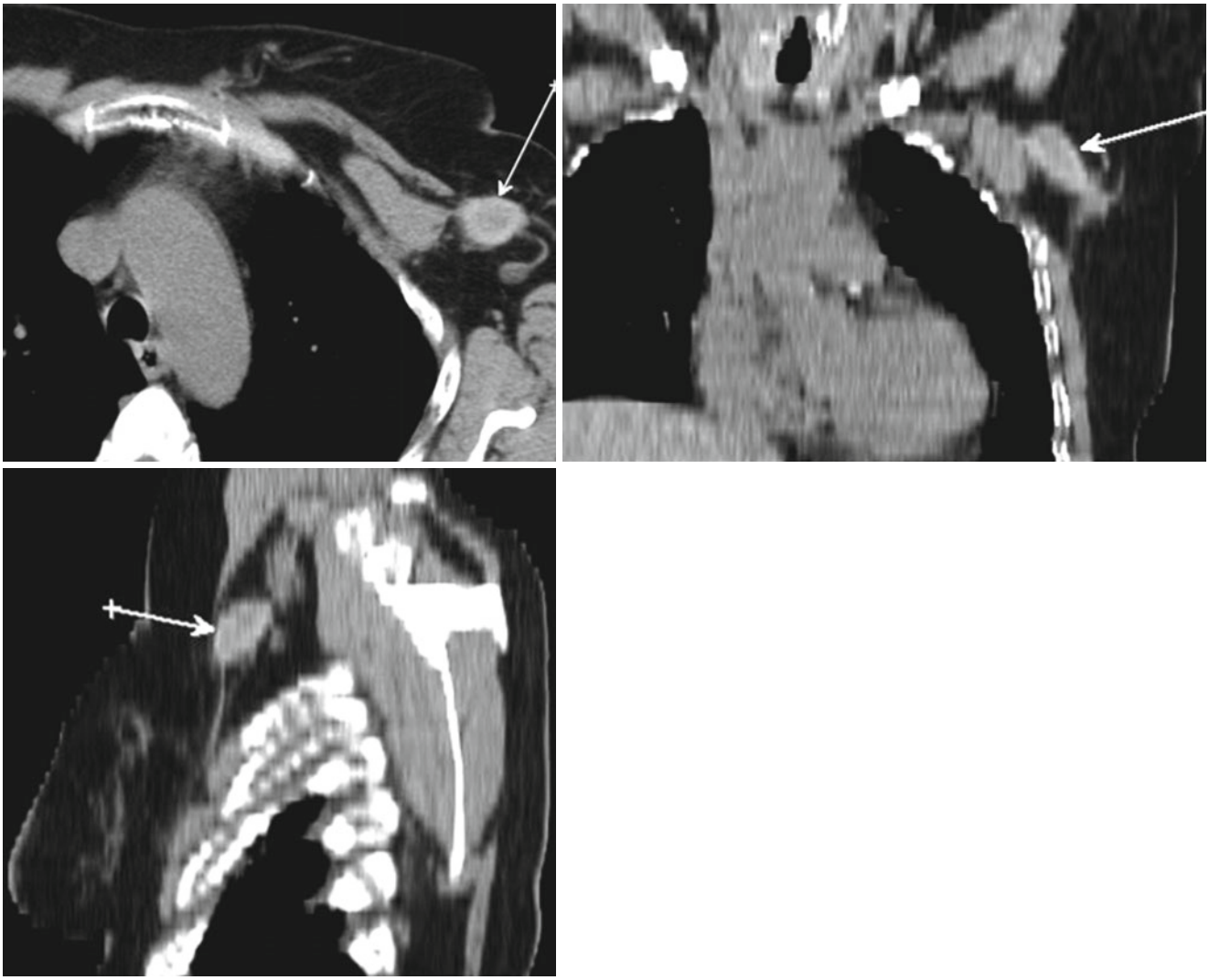


Fig. 9.35 (continued)

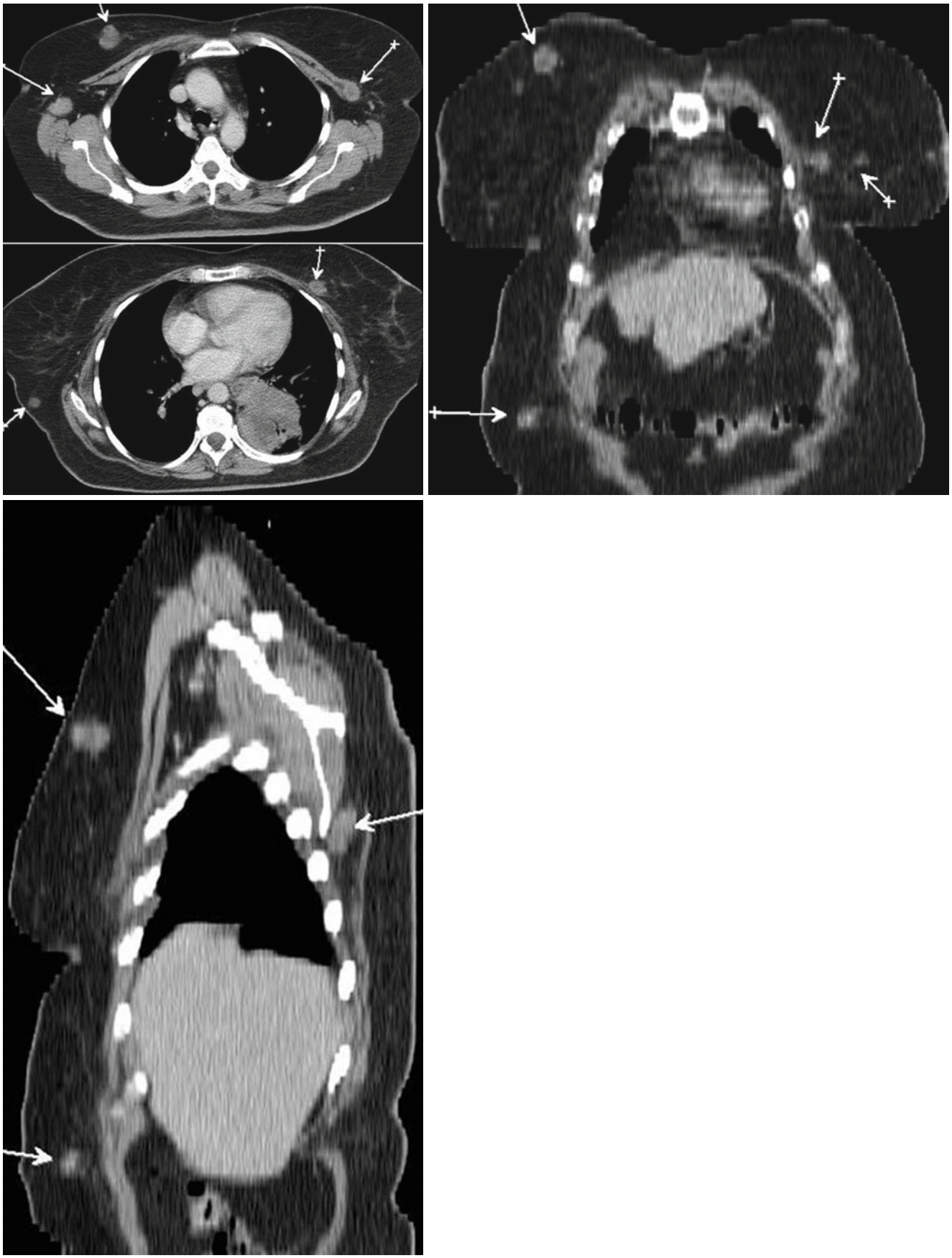


Fig. 9.36 Differential diagnosis: multiple subcutaneous metastases of breast cancer involving breast, thoracic, and abdominal regions are better demonstrated by multidetector CT with multiplanar reconstructions (*white arrows*); the axillae there are detected similar metastases not related to the lymph nodes

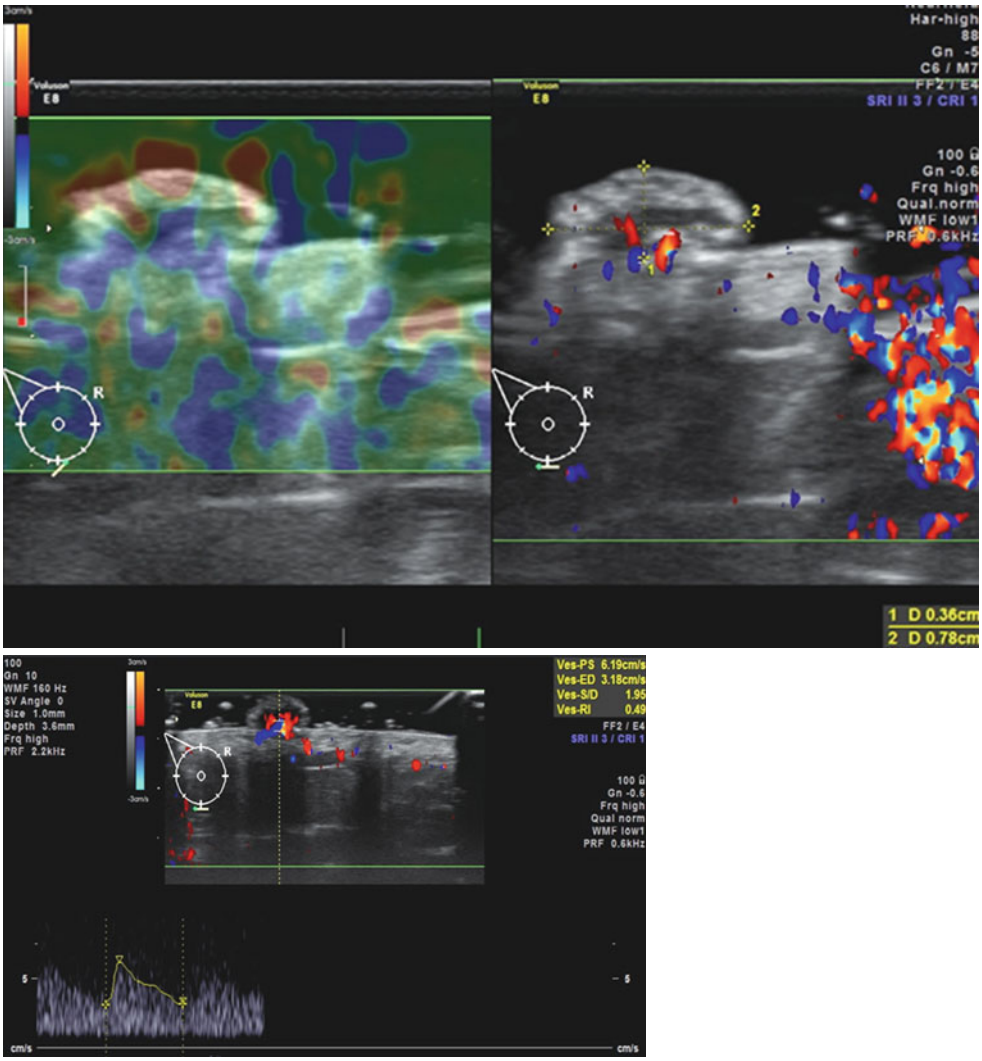


Fig. 9.37 Differential diagnosis: epithelioma in the submammary sulcus—the tumor is strictly located in the skin, without extension under the dermal basal membrane, and has a vascular axis and an intermediate strain (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

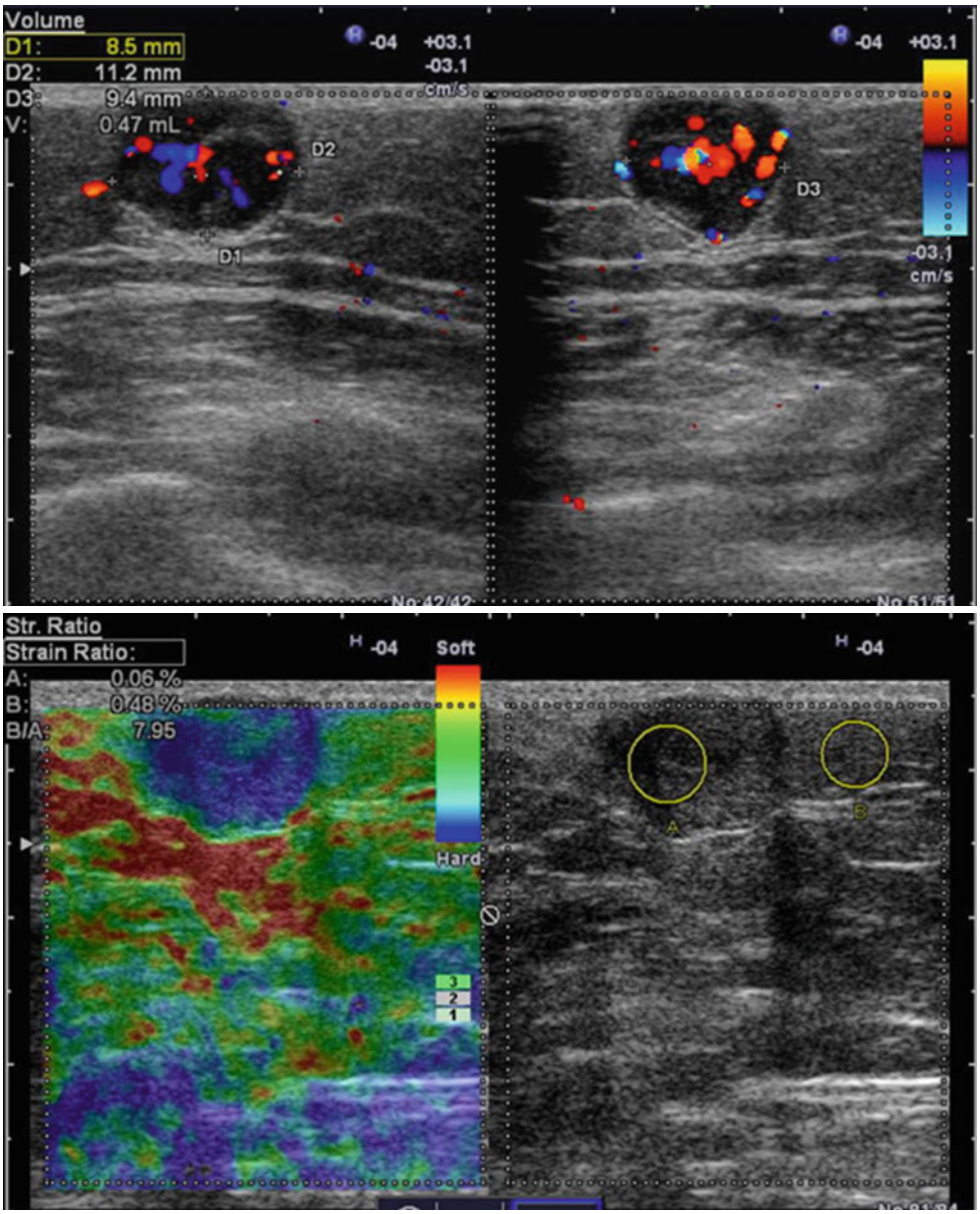


Fig. 9.38 Differential diagnosis: malignant melanoma—the lesion is located between the skin and the fascia superficialis, well delineated, hypoechoic, hypervascular, and with a score 4 Ueno; full US/FBU is useful in detecting small lesions, "buried" in the skin, clinical underestimated (EPOSTM Vienna 2015, doi: 10.1594/ecr2015/C-0266 [1])

Fig. 9.39 *Left picture*: radical mammectomy followed by radiotherapy, with skin burns—pachydermatous thickening, itching, peeling, and brown pigmentation, partially reversible after several months. *Right picture*: conservative breast cancer surgery followed by radiotherapy presenting breast edema and erythema, skin depigmentation, and thickening with loss of elasticity

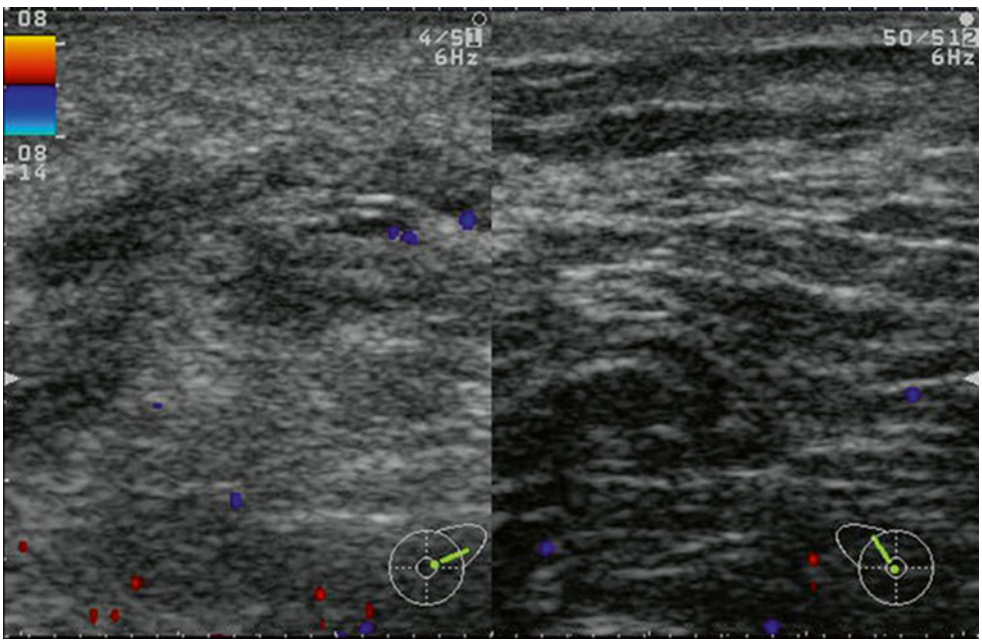


Fig. 9.40 Left breast loss of tissular differentiation and lymphedema with hyperechogenicity after conservative surgery with axillary lymphadenectomy and radiotherapy, compared with the right breast

Fig. 9.41 Skin alterations after radiotherapy: inflammatory changes such as edema, erythema, and hyperthermia are usually reversible; pigmentation alterations such as brown geographic areas or depigmentation may be partially reversible. The ulcerations or necrosis are rare but dangerous, because of reduced tissular trophicity and delayed healing; skin vasculitis is a permanent sequel with only esthetical significance

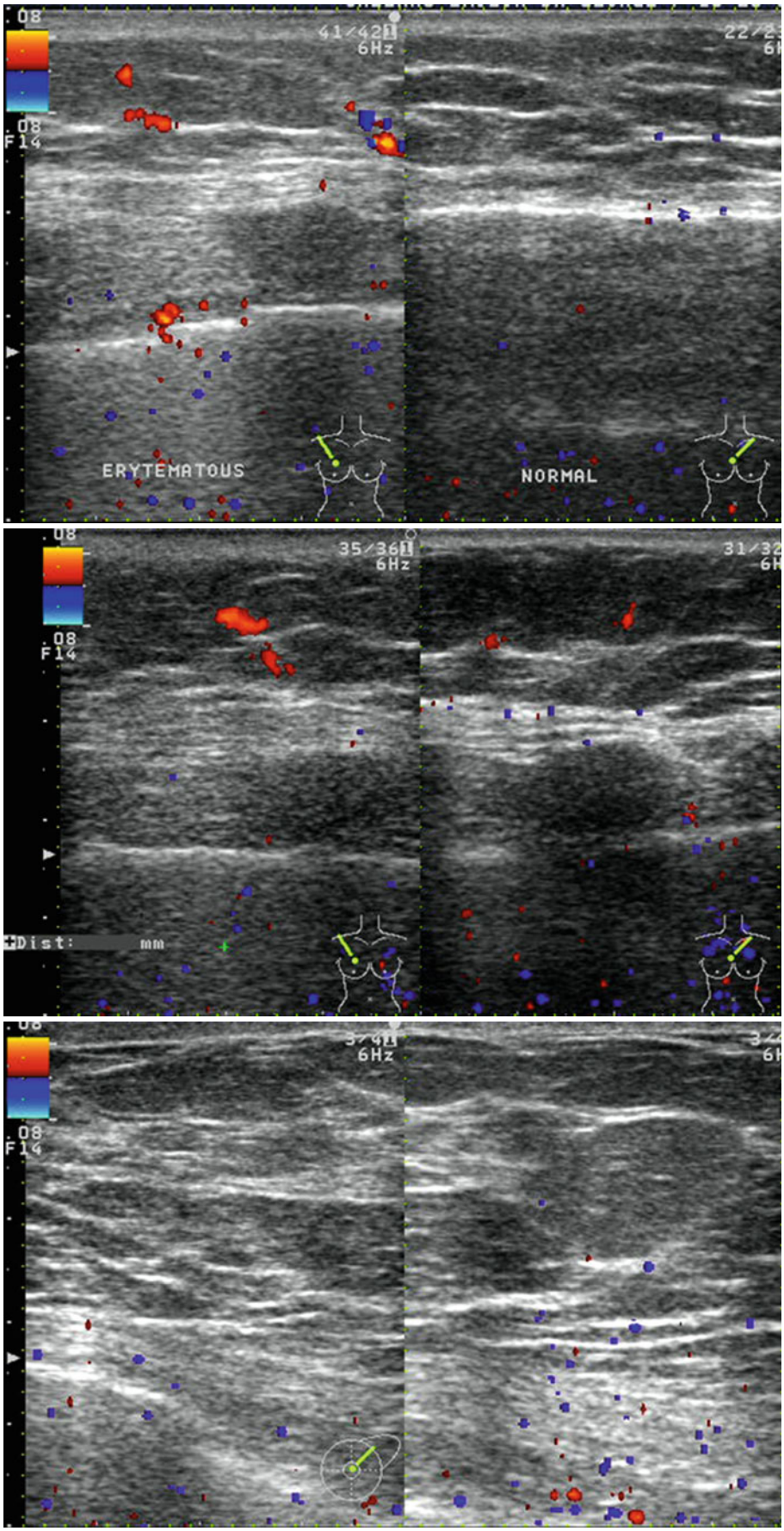


Fig. 9.42 A 76-year-old patient: right breast radiodermatitis strictly located at the irradiation field, clinically with polymorphous erythema; Doppler DE illustrates moderate diffuse hyper-vasculature associated with edema with thickening of all the breast structures: skin, subcutaneous and retromammary fat, breast lobar structures, and pectoral muscles. The limits of the irradiated with the normal nonirradiated tissues are well delimited clinically, and by US, the conserved regions are similar to those of the opposite left breast. US can be used as first intention method in the follow-up of local side effects after radiotherapy

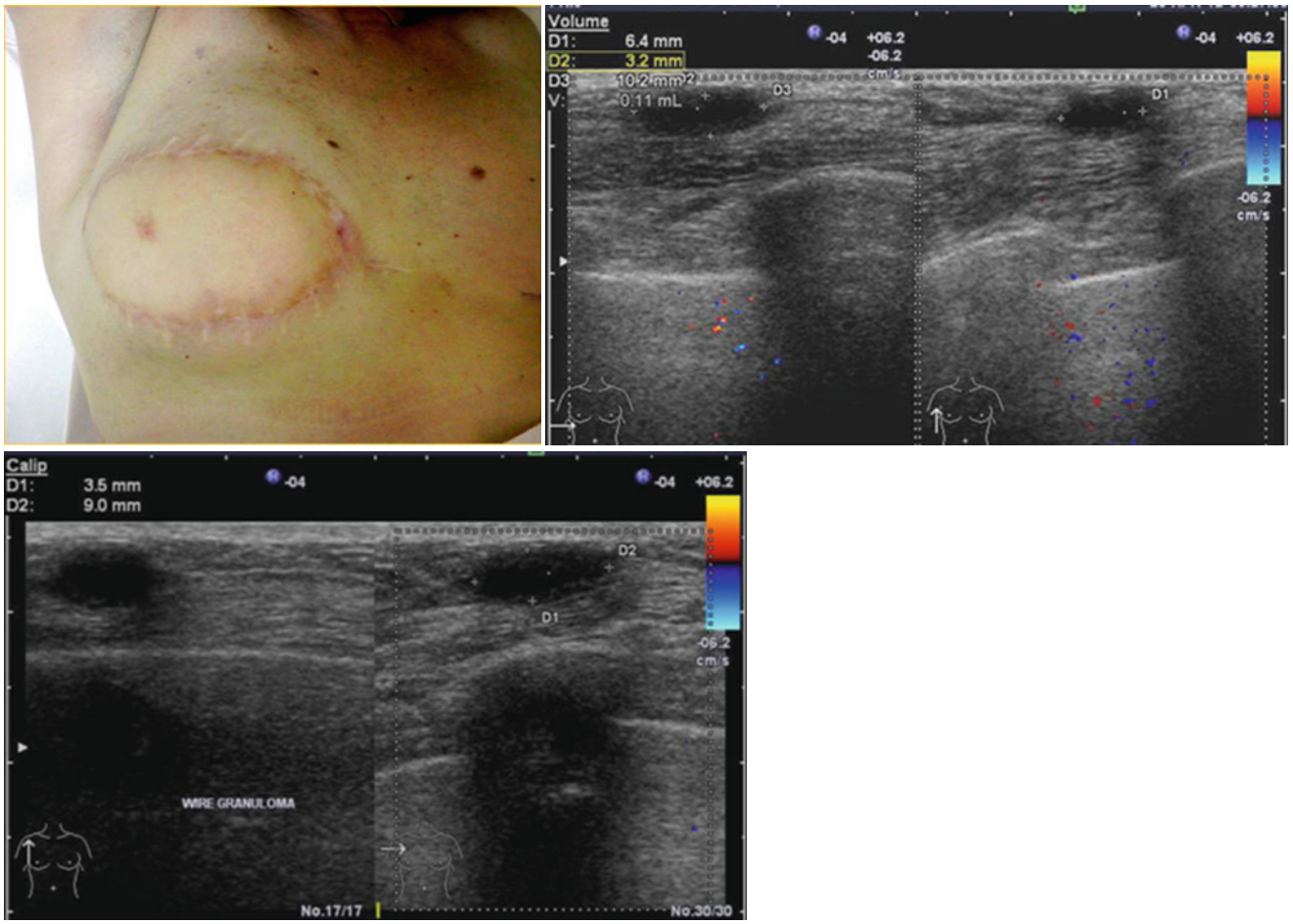


Fig. 9.43 Breast reconstruction with musculocutaneous flap; US survey is recommended for surgical evaluation and detection of the possible secondary malignancies. Suture granuloma with pseudocystic aspect, in the musculocutaneous layer, relatively unchanged after 2 years

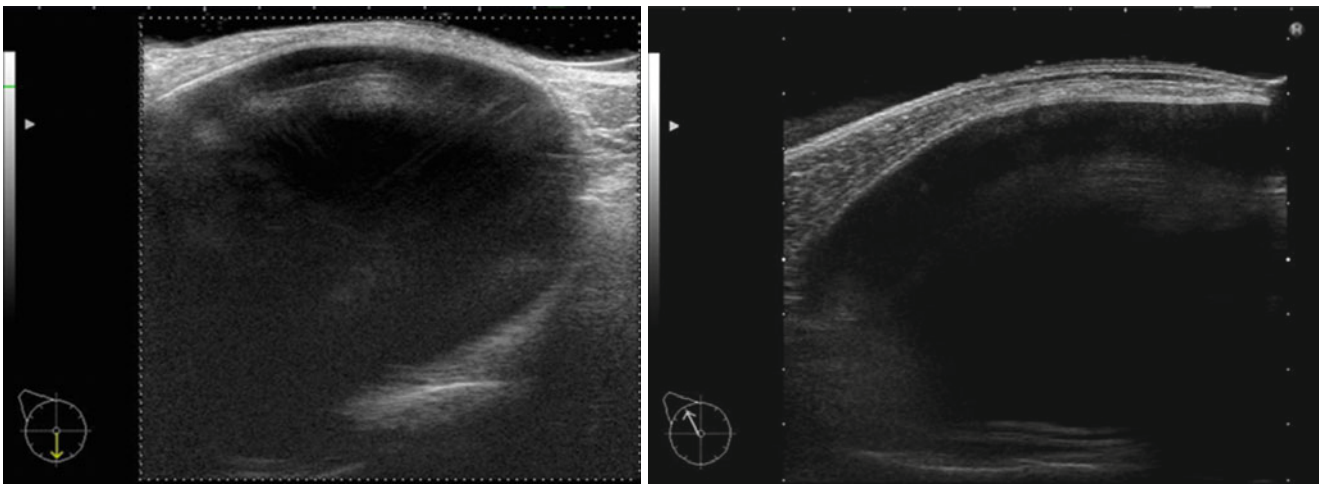


Fig. 9.44 A 35-year-old patient: second step in breast reconstruction with implant—the water bag adapted to the long linear transducer offers the accurate image of the capsule and contents of the prosthesis and the detailed information of the pectoral muscle and of the skin. This technique is painless and safer for the prosthesis as compared with mammography; the acquisitions are faster and cheaper than in the MRI technique

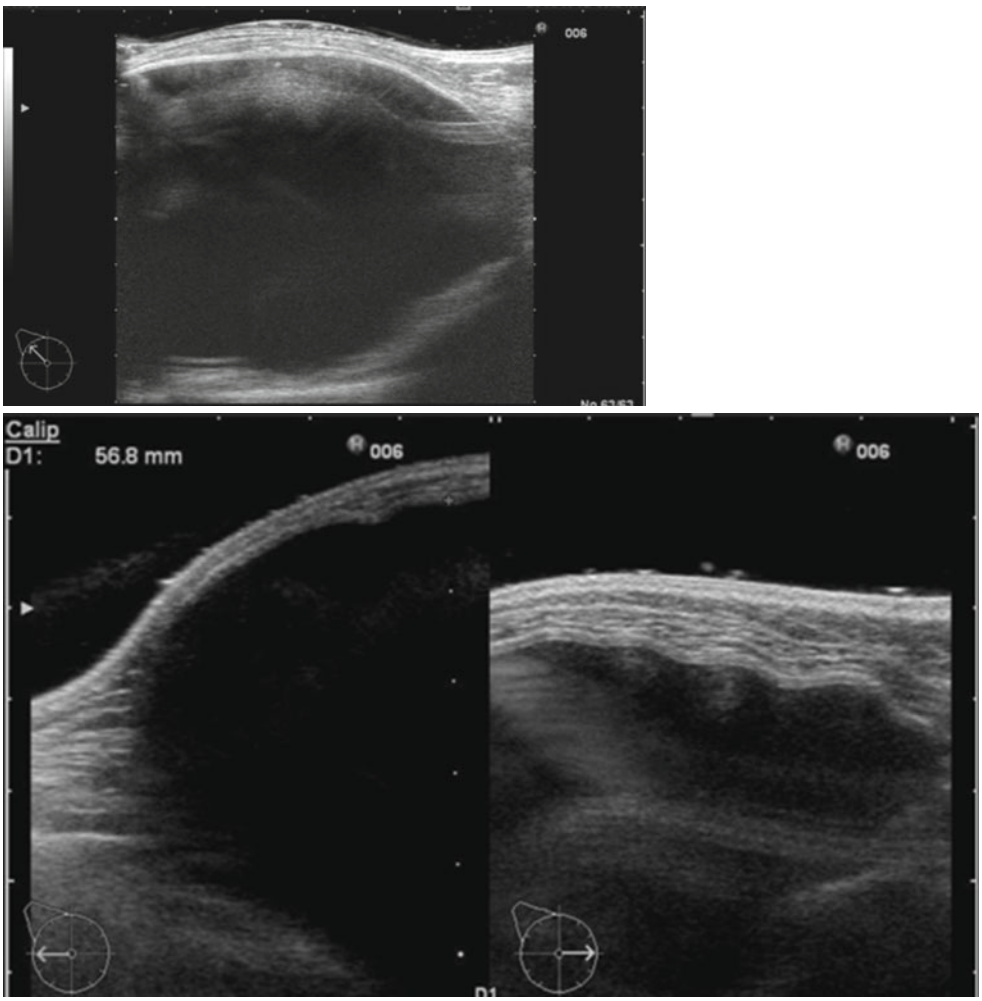


Fig. 9.45 The same case: follow-up examination after 12 months illustrates no malignant secondary lesions, but the prosthesis capsule has folds caused by pericapsular host tissular retraction; the changes are still small, and the surgical revision is not necessary

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