Percutaneous biopsies: Indications and techniques

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Abstract Breast inflammation is a difficult clinical problem as it can result from a variety of causes: specific or non-specific infectious mastitis, which may or may not be complicated, primary or secondary inflammatory mastitis or inflammatory cancer. The main objective of radiology is to eliminate an inflammatory cancer. Other objectives are to characterise an inflammatory condition (where the clinical context is valuable in guiding diagnosis but which often requires a micro- or macrobiopsy) or to obtain a microorganism in cases of complicated infectious mastitis (a diagnostic procedure but also comprising the first stage of treatment). Whether for bacteriological or histological purposes, percutaneous samples therefore play a large part in the diagnostic procedure, other than in the clinical context of pregnancy where mastitis is more easily diagnosed because of its frequency. The guidance method is usually ultrasound, and the needle chosen will depend on the radiological or ultrasound signal: puncture with an 18G needle will be used for a bacteriological sample, microbiopsy of a mass or lymph nodes, or macrobiopsy in the case of microcalcifications.

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The incidence of benign and malignant inflammatory breast conditions is growing. Breast inflammation can be the result of various causes including infectious mastitis, inflammatory mastitis or inflammatory cancer. Since the principal aim in these cases is to eliminate inflammatory cancer, biopsies are widely indicated, assisted by imaging techniques. The next objectives, once inflammatory cancer has indeed been eliminated, are to characterise a non-infectious mastitis, followed, in the case of an abscess, by obtaining a microorganism. Taking bacteriological samples actually includes the first stage of treatment, as will be seen later.

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A variety of causes

The significance of the clinical symptoms of breast inflammation, i.e. redness, heat and possibly pain, is not specific and may be related to any of the three main aetiological situations: infection, inflammation or tumour (Boxed text 1).

Infectious mastitis

Infectious mastitis may be simple or complicated by abscesses. These abscesses may also complicate mammary cysts, sebaceous cysts or galactoceles.

Simple mastitis

Infectious mastitis is more frequent in young patients under the age of 40 during the breast-feeding or post-partum period. Clinical systems consist of erythema, an increase in skin temperature and the spontaneous sensitivity of the breast increased on palpation. In general, it appears in less than 48 hours, frequently with pain, which may be intense and is generally not associated with either skin thickening or a palpable mass. The symptoms disappear rapidly in less than 10 days with suitable antibiotic treatment.

Mastitis complicated by an abscess

Mastitis during lactation is frequently complicated by abscesses, which generally occur within the 3 months following the birth [1]. They are more common in primiparous patients and respond well to antibiotics.

Non-pregnancy related abscesses are encouraged by obesity, diabetes and above all the use of tobacco. They are more common in black patients. Periareolar abscesses must be differentiated from peripheral or deep abscesses [1]:
• periareolar abscesses occur most frequently. From a pathological point of view, they involve malpighian metaplasia of the epithelium of the wall of the lactiferous sinus, with desquamation obstructing the lumen. This results in mastitis followed by an abscess, with fistula tract developing that reach the periareolar region. This type of abscess very frequently recurs. The cause is a microorganism, with staphylococci, streptococci and anaerobic bacteria in decreasing order of causation but with a considerable number of infections being polybacterial. Nipple inversion could encourage this type of abscess. The main factor acknowledged to encourage them is tobacco, possibly through its having a toxic effect on the epithelium of the retroareolar milk ducts;
• peripheral abscesses complicating mastitis are less common. They occur in older patients and are encouraged by diabetes, rheumatoid arthritis, corticosteroids and recent surgery. Staphylococci are the most frequently encountered agents but streptococci and anaerobic microorganisms may also be responsible. The response to antibiotics is good with a low rate of recurrence.

More rarely, an abscess may complicate a skin lesion (an epidermoid cyst) or a breast lesion (a mammary cyst, galactocele, cystostatetonecrosis focus or postoperative seroma). In a series of 197 consecutive patients with clinical symptoms of mastitis, a secondarily infected cyst or a secondarily infected postoperative abscess, both of which produce the appearance on an ultrasound image of a thick-walled abscess, was responsible for the inflammatory symptoms in 9.2% and 7.5%, respectively, of patients included in the series [2].

Specific infectious mastites

These specific infections may be related to a mycobacterium, a fungus or a parasite. They are rare and induce a granulomatous inflammatory reaction. Tuberculous mastitis is encountered in developing countries or in patients infected by the HIV virus. Infection reaches the breast via a retrograde pathway from the axillary lymph nodes, or more rarely via the cervical or parasternal nodes. A blood-borne route is rarer and is encountered mainly in HIV patients.

Fungal infections such as actinomycosis (Fig. 1) and blastomycosis may result in mammary involvement.

The parasitic infection filariasis, with its very specific symptoms of serpiginous microcalcifications often associated with a mass, can be easily diagnosed by mammography.

Non-infectious mastitis

Mastitis may be caused by a certain number of immunological or vascular inflammatory lesions.
Duct ectasia and plasma cell mastitis

Duct ectasia, periductal mastitis and plasma cell mastitis are different evolutionary stages of a single disease. Duct ectasia is found in a peri- or retroareolar, often bilateral, location, typically characterised on a mammogram by long, thick, linear calcifications in the milk ducts. Duct secretions may extravasate into the connective tissue, causing plasma cell mastitis. In the periductal connective tissue, these secretions behave like a foreign body, resulting in the formation of inflammatory granulomas, without necrosis but with infiltrates of histiocytes, lymphocytes, plasma cells and giant cells [3]. In this form of mastitis, the clinical symptoms and ultrasound signs are found in juxta- and retroareolar locations, often associated with nipple retraction. This disease is the prime cause of inflammatory mastitis (accounting for 40 of the 54 cases of inflammatory mastitis identified in the Egyptian series mentioned above [2]).

Inflammatory mastitis complicating surgery

Mastitis after radiosurgical treatment of breast cancer is a frequent form of non-infectious mastitis. In general, there is no solid mass with individual characteristics seen by ultrasound or MRI, and the problem lies in distinguishing this mastitis from a recurrence of the tumour.

Mastitis of immunological origin

Diabetic mastitis is the most typical of this type of mastitis; it occurs in nearly 10% of non-insulin-dependent, young diabetic patients [4]. It often appears as a painful mass, sometimes with inflammatory symptoms, which is often multicentric, bilateral and mobile but hard on palpation. Based on these clinical features alone, it is suspect. It has an auto-immune aetiology, with perilobular and perivascular lymphocyte infiltration combined with fibrosis and lobular atrophy. The mechanism and lymphocyte infiltration are the same as that encountered in other lesions affecting other glands, such as Sjogren’s syndrome in the salivary glands, or Hashimoto’s thyroiditis in the thyroid.

Breast involvement with an immunological origin can be encountered in other diseases [5] such as: Churg-Strauss syndrome, which combines asthma, pulmonary infiltrates, eosinophilia and systemic vasculitis; amyloidosis, in which breast infiltration is rare and late; Wegener’s granulomatosis, which is necrotising vasculitis affecting the respiratory tract, kidneys, skin, muscles, joints and the peripheral...
nervous system, exceptionally with breast involvement; sarcoidosis, which affects the lungs, lymph nodes, skin, spleen and liver, and, again, the breast, rarely but in a manner which is occasionally very revealing.

Inflammatory breast diseases of undetermined aetiology

Lobular granulomatous mastitis, although uncommon (only 1% of cases in the Egyptian series [2]), needs to be recognised. It occurs in women often within 5 years of childbirth. It is diagnosed by exclusion [6]: it is not granulomatous secondary to a disease such as sarcoidosis, Wegener’s granulomatosis or tuberculosis. Nor is there any trauma, foreign body or specific infection. The inflammatory clinical symptoms are very inconsistent (encountered in 11% of cases in a series of 54 patients [7]), but a number of patients tell of a history of prior incision and drainage, of symptoms developing over several months despite taking antibiotics. In practice, there is no clear pattern of clinical, mammographic or ultrasound symptoms and it is biopsies that produce the diagnosis, even when an ultrasound image of a poorly circumscribed mass composed of hypoechoic tubular formations seems to condition this situation [7]. It is important to diagnose this disease because it can be effectively treated with corticosteroids.

Mondor’s disease

Mondor’s disease is a rare disease involving thrombophlebitis limited to the sub-cutaneous veins of the breast [5]. Clinical diagnosis involves finding a palpable, painful, tense band, generally occurring in the lateral quadrants of the breast. Ultrasound examination confirms the diagnosis showing a thrombosed vein at the site of the painful band.

Inflammatory cancers

Inflammatory cancers are the most aggressive form of breast cancer and are responsible for 1 to 5% of such cancers [8,9]. In December 2008, a panel of experts met in Houston to establish diagnostic and therapeutic criteria for these inflammatory cancers. This group’s conclusions have been recently published [10]. The diagnostic criteria are clinical and histopathological. The clinical criteria are breast erythema covering at least one third of the breast, oedema and/or an orange-peel appearance of the skin, a hot breast, with or without a palpable mass, these clinical symptoms all developing within less than 6 months. The histopathological criterion is confirmation of an invasive cancer. Vascular emboli are frequently found in the superficial dermis. Nevertheless, contrary to what has been previously established, this is not an absolute diagnostic criterion of inflammatory cancer: dermal involvement may be absent in more than one case in five of inflammatory cancer, but conversely, the presence of such emboli in the absence of clinical signs of inflammation does not confirm inflammatory cancer.

Inflammatory cancers must be distinguished from locally advanced breast cancers and secondary inflammation of breast cancers. To take into account the concept of evolving inflammatory signs or ‘poussées évolutives’, the Institut Gustave-Roussy [11] has established PEV classification, which is based on the clinical data and helps differentiate true inflammatory cancers from secondary inflammation of breast cancers. Cancers classed as PEV 1 are tumours developing over the previous 2 months, without inflammatory signs. Cancers classed as PEV 2 are palpable masses with tumour inflammation plus skin inflammation involving less than half of the breast, which have developed over more than 4 months. PEV 3 cancers are palpable masses with peritumoural inflammation plus skin inflammation involving more than half of the breast, which have developed in less than 4 months. Strictly speaking, only PEV 3s are inflammatory cancers. Inflammatory cancer is an aggressive cancer often affecting both breasts but, above all, with metastasis found in 30% of patients at the time of diagnosis. The prognosis for these cancers is poor, with mean survival of 3 to 4 years.

In addition to inflammatory breast cancer, a number of neoplastic breast diseases, which are not adenocarcinomas, may present with inflammation: cutaneous or intramammary metastasis, and sarcomas, including angiosarcoma, melanoma, and non-Hodgkin’s lymphoma, for which clinical inflammation is classic but, in reality, rare [12,13].

The main objective: to eliminate inflammatory cancer

When faced with the clinical symptoms of breast inflammation, the main objective is to eliminate inflammatory cancer. Percutaneous biopsies play a large part in eliminating this diagnosis, given the limitations of imaging.

The limitations of imaging

When faced with inflammatory symptoms, the main elements pointing towards inflammatory cancer are the presence of a mass, of grouped microcalcifications and of suspect lymph nodes.

A suspect mass in imaging is a strong reason supporting inflammatory cancer. However, there may be no mass, and anyway, it will not be specific. In the largest study published on inflammatory breast cancers, involving 142 cases [14], a mass was clinically palpable in 62% of patients, and its individual characteristics could be seen on the mammogram in 16% of patients and by ultrasonography in 80% of the cases. In a more recent study [15] comparing mammography, ultrasonography, MRI and PET-TC in inflammatory cancer, a mass was found in 80% of patients by mammography, in 95% by ultrasound, in 96% by PET-TC and in 100% of the patients by MRI. In practice, the absence of a mass in imaging examinations, and in particular with ultrasound (the examination to perform as a first course of action) is a strong argument against inflammatory cancer but does not, nevertheless, eliminate it. On the other hand, the presence of a mass may be encountered in other infectious, and particularly inflammatory diseases. In infectious mastitis complicated by an abscess, the anechoic character of the contents of the mass and the individualisation of a thick wall provide pointers. In inflammatory mastitis, differential diagnosis is still very difficult, since a mass is frequently encountered: it is one of the diagnostic criteria for diabetic mastopathy (Fig. 2). In the series of 54 cases of granulomatous lobular
Figure 2. Insulin-dependent diabetic patient aged 37, with no personal or family history of breast risk. Superior left, junctional, palpable, hard, mobile, sensitive mass of recent appearance. Ultrasound-guided microbiopsy showed a diabetic mastopathy. a: left mammogram, CC; b: left mammogram, lateral-medial oblique. Area of superior left, junctional, architectural distortion (arrow); c: ultrasound image: superior left, junctional, attenuating, poorly circumscribed, hypoechoic mass; d: MRI: axial T2 TSE; e: MRI: axial T1EG, subtraction at the third minute. Intermediate T2 signal spiculated mass (arrow) taking up contrast; f: perivascular (V) and perilobular (L) lymphocytic infiltrate (arrow) associated with dense collagen fibrosis (F).
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mastitis [7], a mass was individualised with ultrasound in 92% of patients, whether it was large with many tubular extensions, or irregular and hypoechoic, highly suggestive of cancer, or a non-specific mass. In mammography, asymmetric density is found more often than a mass (Fig. 3). Besides, while it provides a pointer, the presence of a mass does not confirm the diagnosis of inflammatory cancer.

In this context of inflammatory breast cancer, microcalcifications are present in half of the patients (in 49% of cases in Tardivon’s series of 92 patients [11] and in 56% of cases in Günhan-Bilgen’s series of 142 patients [14]). It should be noted that 10% of these microcalcifications associated with an inflammatory cancer appeared as benign microcalcifications in both the series mentioned above.

Affected lymph nodes are frequently present in inflammatory cancers [8]. Clinical examination and ultrasonography are better for identifying them than mammography. Affected lymph nodes were found in 73% of the cases in Günhan-Bilgen’s series [14] and in 93% of cases in a series published more recently of 76 patients [15]. An important fact is that these lymph nodes are not limited to the axillary region and an ultrasound examination may find them in the subclavicular, supraclavicular or parasternal nodes. Even though rarer, there may also be lymph node changes in an infectious or inflammatory disease. For example, in granulomatous lobular mastitis, lymph nodes were individualised by ultrasound in 28% of patients [7]. The presence of affected lymph nodes, particularly when they are not limited to the axillary region, is a strong reason for suspecting an inflammatory cancer in an inflammatory context; they do not nevertheless confirm the diagnosis, just as the absence of affected lymph nodes does not mean this diagnosis can be eliminated.

Because of the difficulties encountered by clinical examination, mammography and ultrasonography, MRI has been evaluated for differentiating between inflammatory cancer and acute infectious mastitis [16]. In inflammatory cancers, masses were more common and more numerous. Their volume was greater, there was more frequent infiltration of the pectoral muscle and they were more often deep-seated, while acute mastitis lesions were more often subareolar. A recent publication on the MRI appearance of inflammatory cancers shows that these lesions are often multicentric (in 77% of cases), that lymph nodes were identified in MRI in the majority of cases (83%), that the margins of the masses were often irregular, and that their kinetics are explosive [17].

Indications and non-indications for biopsies

Even if a reasoned programme including a clinical examination, a mammogram and an ultrasound examination is important in managing breast inflammation, there is still a wide spectrum of indications for taking tissue samples. This reasoning was well developed in the Egyptian study, which proposed a step-by-step approach to diagnosing the inflamed breast [2], an approach which, in the written update by De Bazelaire, has recently been summarised in the following axioms [3]:

- inflammatory breast symptoms are more often found in inflammatory cancers and infectious mastitis than in non-infectious mastitis;
- the presence of a mass or a suspect adenopathy should help eliminate an infectious origin but not non-infectious mastitis;
- in the absence of a suspect adenopathy, abscesses and their contents help to eliminate inflammatory cancer and non-infectious mastitis and to confirm an infectious origin for the inflammatory symptoms;
- a mass associated with microcalcifications very much supports inflammatory cancer; it must be remembered that microcalcifications in inflammatory cancer may appear benign or undetermined;

Figure 3.  Patient aged 55, with no personal or family history of breast risk. Right palpable retroareolar mass appearing in the mammogram as increased right retroareolar density. a: right CC; b: left CC; c: right lateral-medial oblique; d: left lateral-medial oblique. Density asymmetry with increased right retroareolar density (arrow). Microbiopsy of hyperechoic retroareolar mass under ultrasound showed inflammatory granulomatous mastitis lesions.
• increased density and thickened skin seem to be observed more often in inflammatory cancers that in other forms of mastitis;

This reasoning is still probabilistic, and in clinical practice there are still many indications for biopsies. Rather than define these indications, we will define the non-indications:
• clinical symptoms of infectious mastitis with no suspect lymph nodes, responding well to medical treatment, without recurrence of the symptoms;
• mammary abscess without suspect lymph nodes, for which the indication is not a microbiopsy to eliminate an inflammatory cancer but ultrasound-guided puncture, firstly for therapeutic evacuation and secondly, so as to determine the microorganism;
• the characteristic appearance, on the centred mammogram, of periductal mastitis with thick, linear, branched, microcalcifications with a clear centre;
• postoperative cytosteateonecrosis, unless there has been a free interval and the clinical symptoms have recurred after surgery.

In other cases, biopsy is recommended (Fig. 4).

Guidance method and method for taking biopsies

The guidance method and the needles used for biopsy depend on the target from which the sample is to be obtained. When it is a mass, the biopsy will be performed using ultrasound with a Tru-cut 14G needle. A lymph node biopsy (which must always be performed even if samples have also been taken from a breast mass) may be performed either with an 18G needle with a Tru-cut type system, or by FNAC, bearing in mind that the presence of inflammatory cells may lead to a false-positive. In our practice, we prefer in this context to perform microbiopsies on the lymph nodes. When microcalcifications are concerned, the sample is taken by stereotactic microbiopsy, remembering that these microcalcifications may appear benign. When there is any area of microcalcifications within inflammatory plaque, a macrobiopsy is indicated.

Finally, in the inflamed breast with suspected inflammatory cancer, a skin microbiopsy is recommended to show any possible dermal lymphatic emboli which, even if they do not provide an absolute diagnostic criterion, have diagnostic and prognostic value. The consensus conference [10] recommended taking these samples from areas where skin colour modification is most distinct. These biopsies are performed with a 2 to 8 mm diameter punch pushed in vertically with a rotational movement. A carrot recovered with forceps is sectioned at the bottom with a scalpel. The biopsy site is compressed manually, with a Steri-strip applied so as to bring the edges together, and is covered with a waterproof dressing to be kept in place for 2 days. This biopsy is doubly useful: in certain cases it permits inflammatory cancer to be diagnosed when the breast and/or lymph node biopsies are negative, and it is also useful for making a prognosis, since it is acknowledged that the prognosis for an inflammatory breast cancer with a positive skin biopsy is poorer than for an inflammatory breast cancer with a negative biopsy [18].

Results of the biopsy: characteristics of inflammatory carcinomas

Inflammatory carcinoma is defined therefore clinically and histologically as the presence of an invasive cancer in the context of breast inflammation. Histological dermal involvement is a classic sign (emboli) but it is not essential for the diagnosis. The notion of silent inflammatory cancer, which was formerly considered to be a form of inflammatory cancer consisting of dermal involvement with lymphatic emboli but without signs of inflammation, must be withdrawn.

Inflammatory cancers do not correspond to a specific histological type but typically have the histological and phenotypic characteristics of an aggressive tumour [9,10]. Usually they are high-grade infiltrating ductal carcinomas, frequently accompanied by a high-grade in situ component and superficial dermal lymphatic emboli (Fig. 5). They are not generally hormone-dependent and are characterised by a high proliferation index, and usually there is over-expression of the HER2 protein and high levels of EGF receptors, indicating strong angiogenesis. They also have a greater rate of mutation of the p53 protein, which, moreover, is a factor for a poor prognosis in inflammatory cancers. On the other hand, the same proportion is found of infiltrating ductal carcinoma versus infiltrating lobular carcinoma as in other invasive cancers.

The second objective: characterisation of the specific type of inflammatory or infectious mastitis

Apart from complicated postoperative cytosteateonecrosis, post-radiation breasts and duct ectasia or periductal mastitis, inflammatory mastitis is a rare cause of breast inflammation, found most frequently due to a palpable mass. Diagnosis by imaging is impossible and characterisation of the mastitis must rely on the biopsy.

Non-specific imaging symptoms

In these types of mastitis, masses are more common than inflammatory signs: the series concerning granulomatosus lobular mastitis found a mass in more than 90% of the patients [7]. The cases of diabetic mastitis reported [19] involved often mobile, irregular, poorly circumscribed, painful and frequently hard masses, which were often bilateral but can be single. They occur particularly in young patients (mean age 37 in a series of 36 cases published more than 20 years ago [20]) and individualising the mass by mammography in the often dense breasts is difficult. Ultrasound more easily detects poorly circumscribed hypoechoic masses (Fig. 2c), in the majority of cases with characteristic significant posterior attenuation.

Mastitis related to other even more unusual immunological causes has no specific features in clinical, mammographic or ultrasound examinations of the breast. Lymph node changes are rarer than in infectious mastitis or inflammatory cancer, but are still possible. Given this failure as regards clinical examination and imaging of the breast, evidence for diagnosis must be based on the medical history,
Figure 4. Patient aged 55, with no personal or family history of breast risk. Right retroareolar induration and a certain amount of recurring right nipple discharge. No abnormality on mammogram or ultrasound image. Macrobiopsy under MRI of right retroareolar ductal non-mass enhancement showed inflammatory duct ectasia lesions. a: right mammogram CC; b: right mammogram, lateral-medial oblique; a–b: no rod-like linear calcification; c: breast MRI: axial T1 EG, subtraction at the third minute: retroareolar duct enhancement (arrow); d: distended milk duct, enclosing foamy histiocytes, surrounded by an inflammatory infiltrate.

Figure 5. Carcinomatous mastitis. a: infiltration of the dermis by a poorly differentiated ductal carcinoma; b: lymphatic emboli (EL).
the associated clinical symptoms and for the most part, on the biopsy.

The role of associated clinical signs

In the rare forms of inflammatory mastitis, only the clinical context gives a pointer to a diagnosis. The clinical signs of systemic diseases which may be accompanied (rarely in practice) by breast involvement do not come within the field of this paper.

Indications and performing the biopsy taking into account histopathological requirements

Biopsies can be microbiopsies or, if necessary, macrobiopsies. It is important to provide a pointer to the diagnostic request from the clinical context, in order to help the histologist in his work. If a specific infectious mastitis is suspected (tuberculosis, a fungal infection for which the symptoms are often less explosive than for ordinary infectious mastitis), it is equally important to send samples for bacteriological and mycological examination.

Results of the biopsy

Several types of lesion can be identified from the histological sample. These may be acute inflammatory lesions, granulomatous lesions, or indicate lymphocytic mastitis. If the biopsy sample does not remove the doubt, if treatment is ineffect tile or if episodes recur, surgery may be required.

There are many aetiologies for granulomatous mastitis. The diagnosis of idiopathic granulomatous lobular mastitis is by elimination and can only be made after having eliminated an infectious cause, particularly tuberculosis (Fig. 6). Without any context, additional specific staining methods will be systematically used to identify pathogenic agents (PAS, Grocott, Ziehl-Neelsen, etc.) but samples for bacteriology are often more useful for detecting certain microorganisms, particularly mycobacteria. The presence of necrotising epithelioid granulomas with giant cells strongly suggests tuberculosis, but the diagnosis is only confirmed when acid-alcohol resistant bacilli are found.

In duct ectasia, where the clinical and radiological picture can sometimes be worrying, particularly in the absence of bilateral, retroareolar, linear, thick microcalcifications, the diagnostic difficulty is having sufficient evidence to eliminate a carcinoma, hence the usefulness of having good samples of the lesion, generally obtained by macrobiopsy. These will show dilated ducts surrounded by an inflammatory sheath of lymphocytes/plasma cells evolving towards fibrosis. Duct rupture can also produce a granulomatous reaction.

Lymphocytic mastopathy, or sclerosing lymphocytic lobulitis, is a non-infectious lesion characterised by a lymphocytic (predominantly B type) inflammatory infiltrate forming around the lobules and vessels. It evolves towards collagen sclerosis and atrophy of the lobules. Where there is a known diabetic or auto-immune disease (Hashimoto’s thyroiditis, Sjögren’s syndrome, systemic lupus erythematosus, etc.) diagnosis is less problematical, but the appearance is sometimes rather non-specific, particularly in microbiopsies.

The third objective: obtaining a microorganism from abscesses sampled

When faced with a walled-off breast abscess seen with ultrasound, puncturing with an 18G needle serves several purposes:

• it confirms the diagnosis of an abscess (by evacuating pus), and allows the microorganism to be identified, bearing in mind that staphylococcus is the microorganism most frequently encountered but that a number of abscesses are of polybacterial origin, involving staphylococci, streptococci and anaerobic organisms;

• it forms the first stage of treatment.

Generally speaking, the simplest and least aggressive measures are recommended for these breast abscesses, with repeated puncture aspirations preferred over percutaneous drainage, which only a few years ago replaced surgical drainage. In the case of an abscess of more than 2 cm in diameter, instillation/aspiration of isotonic saline is recommended, continuing until the liquid becomes clear.

When, as is often the case, the wall of the abscess is thick, if cultures are negative and/or the symptoms persist or recur, you should not hesitate to take a microbiopsy of the wall to look for another cause (inflammatory mastitis and, particularly, inflammatory cancer). Indeed, inflammatory cancer must always be considered when the symptoms are chronic and do not respond to antibiotics and aspiration, even if the clinical symptoms and ultrasound indicate an abscess. In a training article recently published in Radiographics [1], considering 20 studies which had included 975 patients with suspected breast abscesses, six cases (0.6%) of inflammatory cancer were identified.

Generally speaking, following an abscess there should be at least a clinical examination with or without ultrasoundography repeated after 1 or 2 weeks. If there has been a clinical response, if the abscess did not occur during pregnancy or breast-feeding, a mammogram could be performed in patients over the age of 35. If the clinical response is
incomplete, the ultrasound examination needs to be repeated, aspiration begun again and possibly a biopsy should be performed of the wall of the supposed abscess.

**Disclosure of interest**

The authors declare that they have no conflicts of interest concerning this article.

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