Management of Mastitis, Abscess, and Fistula

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KEYWORDS

• Subareolar abscess • Subareolar fistula • Zuska's disease • Periductal mastitis
• Squamous metaplasia

KEY POINTS

- Unlike lactational abscesses and nonlactational peripheral breast abscesses, subareolar abscesses tend to recur or develop duct-cutaneous fistulae.
- Smoking and/or congenitally cleft nipples lead to squamous metaplasia in terminal lactiferous ducts.
- Squamous cells secrete keratin which fills and plugs the terminal ducts leading to subareolar infection.
- Successful treatment of recurrent periductal mastitis or Zuska's disease (ZD) requires excision of the obstructed terminal ducts in the nipple.

INTRODUCTION

There are many breast conditions that produce pain or inflammation, not all of which involve infection. Mastalgia, granulomatous mastitis, and other noninfectious mastopathies are covered elsewhere in this publication. Breast infections are broadly categorized as either lactational or nonlactational, and the former are also covered in a different section. The focus of this article is on nonlactational breast infections which are generally subdivided into subareolar and peripheral breast infections because there are significant differences in the etiology and clinical course of each. Peripheral abscesses behave like abscesses in other parts of the body[1] and usually do not recur after treatment with antibiotics, aspiration, or incision and drainage. Unlike peripheral breast and other soft tissue abscesses, infections in the subareolar region have a much higher tendency to recur.

SUBAREOLAR ABSCESSES AND FISTULAE

Background

Few conditions have been more exasperating to patients and challenging to surgeons than chronic subareolar abscesses and fistulae. The fistulous condition was reported

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in 1951 as a distinct clinical entity separate from abscesses elsewhere in the breast by Zuska, Crile, and Ayers.[2] Joseph Zuska was George Crile's resident at the Cleveland Clinic, and his wife suffered from bilateral breast fistulae, stimulating his interest in the condition.[3] Following his wife's operation at the Cleveland Clinic, Zuska's interest in the disease continued at the National Naval Medical Center where 4 additional patients were operated upon before the publication. The authors were prescient in recognizing the underlying problem and the *sine qua non* for successful treatment. "Local excision of the sinus tract and its indurated base without removal or incision of the terminal portion of the involved duct results in recurrence of the abscess or in persistence of the drainage," they wrote. "The most effective treatment of fistulas of lactiferous ducts is excision of the terminal portion of the involved mammary duct along with the indurated base of the sinus."

Although several articles were published in the next few years that cited the work of Zuska, and colleagues,[4–6] the newly described entity did not enjoy widespread dissemination in the surgical community. Two decades later, George Crile, frustrated because surgical textbooks were still not including the topic and students were not being taught about it, suggested the catchy eponym Zuska's disease (ZD) in hopes that the condition would become more widely recognized, and proper treatment would be implemented by surgeons.[7] The suggestion caught on, and the condition is now commonly referred to by its eponym. Crile also suggested an alternative name, SMOLD, for squamous metaplasia of lactiferous ducts, and that name is also occasionally used to describe the same clinical entity.

The terminology in the literature has been confusing, and various terms including periductal mastitis, duct ectasia, varicocele tumor, plasma cell mastitis, comedomastitis, mastitis obliterans, and secretory disease of the breast have been used to describe various conditions that involve subareolar ducts.[8] In 1989, Dixon postulated that all of those names, including periductal mastitis and duct ectasia, referred to different stages of the same disease process. However, after prospectively evaluating 14,225 patients, Dixon, and colleagues,[9] concluded that the 2 conditions were separate, unrelated entities. Dixon defines periductal mastitis as patients who have a periareolar inflammatory mass, a nonlactational subareolar abscess, or a mammary duct fistula. Although he did not evaluate patients for squamous metaplasia, what he calls periductal mastitis is certainly the same as ZD. This perplexing condition affords the opportunity for surgeons to become one more in a long list of physicians who have failed to solve the patient's problem or to earn the unending gratitude of the patient by recognizing the underlying pathogenesis and curing her with an appropriate operation.

Presentation

Although patients with subareolar abscesses and fistulae have been reported from as young as 14[3,10,11] to as old as 79[12] years and to involve men[13–15] as well as women, the typical presentation is a woman in her thirties. Most commonly she will have either a history of chronic smoking,[16–19] a congenital cleft in the central portion of the nipple,[5,6,12,20,21] or both. If the patient is seen early in the course of the disease, she may have only pain and erythema in the peri-areolar region, with or without a palpable mass. As the disease progresses, an abscess usually develops and is almost always located at the border of the areola (**Fig. 1**). If an abscess has previously drained spontaneously or has been incised, an intermittently draining fistulous opening might be present at the border of the areola (**Fig. 2**). Commonly, exasperated patients present after having had multiple drainage procedures and operations that have failed to correct the underlying problem. Lambert, and colleagues,[22] reported an average of 5 prior subareolar abscesses in 37 patients before being seen by them. One patient had

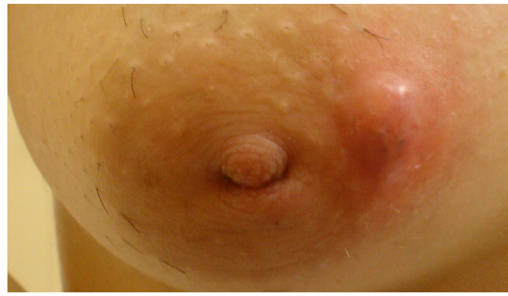

Fig. 1. Subareolar abscess Note the abscess is pointing at the border of the areola. Note also the congenital cleft in the nipple.

experienced 27 abscesses and had 15 operations before the correct diagnosis was made.

Pathogenesis

Normal breast ducts are composed of 2 cell layers of cuboidal epithelium. In patients with ZD, the terminal ducts within the nipple almost always contain multiple layers of squamous metaplasia. Keratin, which is secreted by the squamous epithelial cells, fills and plugs the lumen of the ducts (**Fig. 3**). The pathological findings are strikingly similar to those of ruptured epidermal inclusion cysts, and some reports of ruptured subareolar inclusion cysts in the literature are likely ZD that has been misinterpreted by the pathologist.[23–25] There are 2 conditions that are known to be associated with squamous metaplasia of the nipple ducts with keratin plugging—smoking and congenitally cleft nipples.

Smoking

The association between cigarette smoking and ZD was first reported by Schäfer, and colleagues,[16] in 1988. They found that 90% of patients with the disease smoked or had a history of heavy smoking compared with 37% of matched controls. Others have confirmed the association with smoking.[17,19] Zhang and colleagues,[26] reported that only 2.6% of patients smoked, but over half of their patients had excision of a mass without a history of abscess or fistula, and no histologic evidence was given that indicated they had findings typically seen in the syndrome. Thirty-seven percent of their patients had nipple retraction.

Fig. 2. Fistula at border of areola. Note fistulous opening at 11:30 position. Note congenital cleft in the central portion of nipple.

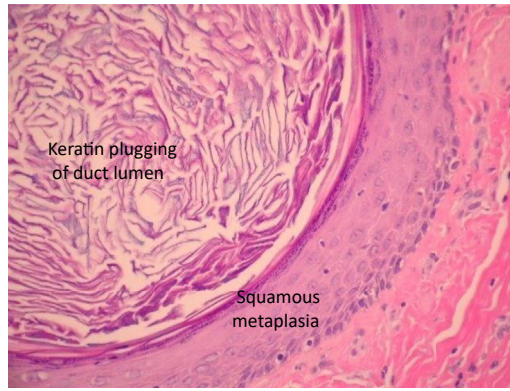

Fig. 3. Terminal duct in nipple. The normal two cell layers of cuboidal epithelium in the duct wall have been replaced with multiple layers of squamous epithelium. Keratin secretions fill the duct lumen.

Some authors have proposed that smoking leads to toxins in breast fluid that directly damage breast ducts,[17] and metabolites of nicotine have been documented to be in breast fluid after smoking.[27] Meguid, and colleagues,[18] found that 23 of their 24 patients (96%) smoked, and they postulated that vitamin A deficiency might be etiologic in the development of squamous metaplasia. It has been known for a long time that the deprivation of Vitamin A in laboratory animals results in the replacement of normal epithelium with stratified keratinizing epithelium.[28–30] There is evidence that levels of beta-carotene (a vitamin A precursor) and other plasma carotenoids are lower in people who smoke than in those who do not.[31–33] Subsequent laboratory experiments,[34] however, have demonstrated that pharmacologic doses of beta-carotene actually increase keratinized squamous metaplasia, so the role of beta-carotene deficiency, if any, in the development of squamous metaplasia remains unclear.

Congenital cleft nipple

Many patients with ZD have had a congenital cleft in the central portion of their nipples for as long as they can remember (see **Figs. 1** and **2**). Atkins first made the association between congenital nipple inversion and ZD in 1955, noting that it was present in 19 of 28 (68%) of his reported cases.[5] He postulated that the nipple inversion made it difficult for secretions to drain, causing them to build up in the duct and become infected, eventually building enough pressure to drain through the nipple orifice or rupture into the surrounding subareolar space. Caswell, and colleagues,[6] independently noted the association between congenital nipple inversion and ZD in 1956 and attributed the development of infection to "maceration" that occurred in the depth of the nipple groove. Persistent moisture in the depths of the nipple crevice with subsequent low-grade inflammation seems likely as a source of squamous metaplasia in adjacent ducts as it is known that chronic irritation can lead to squamous metaplasia.[35] Caswell reported 6 patients who had multiple unsuccessful procedures for ZD before the causative role of fistulous tracts connecting with the surface in the groove of the cleft nipples was realized.[6] Excision of the fistulous tract with the correction of the inverted nipple was successful in all 6 patients. Others have also noted the presence of nipple inversion.[17] Although nipple retraction can occur from multiple inflammatory events and scarring from previous operations, many reports of nipple retraction attributed to such causes in the literature are likely unrecognized congenital deformities.

Nipple piercing

There have been increasing reports in the literature over the last few decades that nipple piercing leads to delayed development of subareolar abscesses,[36] some of which are caused by organisms not usually seen in the breast. There have been 2 reports of patients infected with mycobacteria[37,38] and one with gonococcus.[39] David, and colleagues,[40] found that patients with nipple rings required more aspirations for abscess resolution than those without nipple rings. There has been one report of recurrence following an operation that was required because of nipple piercing,[36] but Gollapalli, and colleagues,[19] did not find a relationship between nipple piercing and an increased risk of recurrence following the treatment of the initial abscess.

The pathogenesis of abscess formation following nipple piercing seems to be a disruption of nipple ducts which allows entry of bacteria along with scarring of the ducts. There have been no reports to date as to whether squamous metaplasia and keratin plugging occur in patients with nipple piercing. It is unclear at this time whether these patients will experience recurrent problems and, if so, whether successful treatment can be accomplished by the removal of the device or will require excision of the central ducts within the nipple.

Nonoperative treatment

Cessation of smoking

The surgeon should discuss the association of smoking with the disease process with those patients who smoke. There are many health-related reasons for patients to stop smoking, and that should be encouraged. There are no good data, though, to suggest that the cessation of smoking will alter the course of the disease once the squamous metaplasia and keratin plugging have been established and symptoms have developed. It is likely it would decrease the likelihood of problems developing in other ducts or in the contralateral breast. As always, the surgeon should take care not to be judgmental, shaming the patient for "causing" the problem and adding guilt to her already exasperating symptoms. There is no reason to delay an operation in hopes that the patient will stop smoking. Most of the time she will probably not be able to stop, and in the author's experience, smoking does not seem to interfere with healing in these patients.

Antibiotics

Antibiotics play an important role in the management of ZD, whether the patient is seen at the first onset of disease or after recurrent disease when operative intervention is necessary. Several authors[11,18,41] have reported that the organism associated with first-time subareolar abscesses was *Staphylococcus*, but mixed flora and anaerobes were associated with recurrences. Multiple authors have found associations between anaerobic organisms and subareolar abscesses,[42] nipple retraction,[43] and smoking.[17–19,44,45] Russell, and colleagues,[46] found that the combination of clindamycin and flucloxacillin gave excellent coverage for all categories of breast infections. Moazzez, and colleagues,[47] found that the best oral broad-spectrum coverage for breast abscesses was provided by trimethoprim-sulfamethoxazole, but anaerobic coverage such as metronidazole should be added while awaiting culture results from recurrent abscesses, particularly if needle aspiration is conducted and the abscess cavity is left intact to heal without being exposed to oxygen.

Aspiration of abscess

If antibiotics do not prevent the development of an abscess or if one is present at the patient's initial presentation, the next step depends on the nature of the abscess. If the cavity is not extremely superficial, and relatively normal skin overlies it, aspiration

frequently allows resolution and has been shown in a randomized trial to allow more rapid healing than open drainage.[48] Although there is a tendency to go straight to incision and drainage with abscesses greater than 3 cm in diameter, there is evidence that aspiration can be successful even in larger abscesses.[40] Although aspiration can be conducted with palpation alone, the use of ultrasound facilitates complete emptying and irrigation of the cavity in addition to monitoring for reaccumulation of pus.[49,50] It is sometimes necessary to aspirate the cavity several times over a 7–10 day period to achieve resolution.

A typical sonographic appearance of a subareolar abscess is shown in **Fig. 4**. Before aspiration, local anesthetic should be generously infiltrated around the abscess cavity. A three-way stopcock and intravenous tubing can be used, but a simple, cost-effective method is to introduce a 16 or 18-gauge needle on a syringe into the cavity (**Fig. 5**A) and aspirate the pus. Once the pus is evacuated, the needle can be grasped with a hemostat, and the pus-filled syringe can be replaced with one filled with lidocaine (**Fig. 5**B). Even though local anesthetic has been widely injected, the patient will still experience pain if the cavity is vigorously distended with saline. The lidocaine should be slowly instilled into the cavity to allow pain-free distention. After a moment, the cavity can then be thoroughly irrigated by swishing the lidocaine into and out of the cavity (**Fig. 5**C).

Incision and drainage

If the patient presents with a superficial abscess that has thin, attenuated skin overlying it, it is best to proceed with a simple incision and drainage in the office under local anesthesia. There is usually no need to make a large incision, insert a drain, or pack the wound. Evacuation of the pus that is pointing at the skin allows antibiotics to resolve the remainder of the phlegmon.

Operative management

Lannin[10] reported that antibiotics, aspiration, or incision and drainage resolved the problem in 33 of 67 patients (49%), so it is best not to proceed to definitive surgery if the patient has no history of previous treatment failures and does not have an established fistula. If the patient gives a history of recent treatment of the problem, has a fistula, or recurs within a few months of initial treatment, it is probably best to proceed with a definitive operation once the acute inflammation has resolved, especially if there is a congenital cleft in the nipple.

There are no randomized trials or even large series in the literature to give definitive guidance on the technical aspects of a curative operation, but there is now general

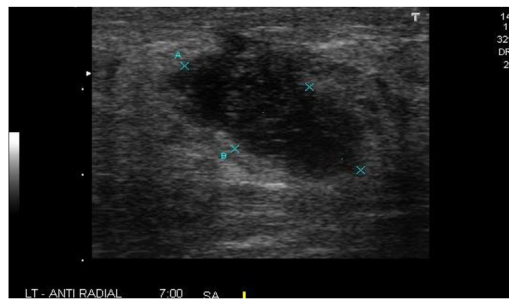

Fig. 4. Sonographic appearance of subareolar abscess. Note the fairly well-circumscribed, heterogenous, hypoechoic mass.

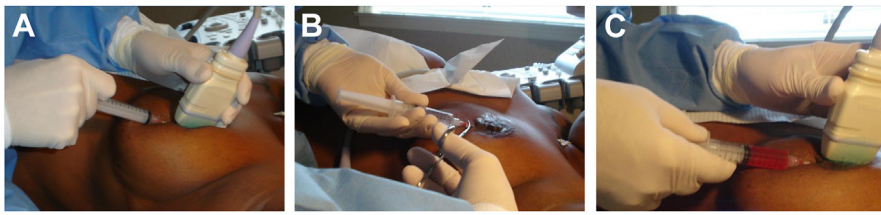

Fig. 5. Ultrasound-guided aspiration of abscess. (*A*) Large bore needle is inserted into abscess cavity and the pus is aspirated. (*B*) Needle held in place with hemostat while pus-filled syringe is replaced with one filled with lidocaine. (*C*) After slowly distending cavity, the lidocaine is vigorously swished in and out to thoroughly irrigate the abscess cavity.

agreement that the *sine qua non* for the resolution of the problem is to remove the keratin plugged ducts in and immediately below the central core of the nipple.[3,10,11,18] A cleft or inverted nipple should also be corrected at the time of duct excision.[6,12] The unresolved issue is whether this goal is best accomplished through a circumareolar incision utilized by Dixon[51] or a radial elliptical incision advocated by Lannin.[10]

Dixon reported that 91% of circumareolar wounds healed primarily, and Lannin had a 62% success rate with primary healing when using a circumareolar incision (**Table 1**). When Lannin switched from a circumareolar to a radial elliptical approach, he found that 100% of 26 wounds healed without complication.[10] Recurrence required ipsilateral re-excision in 25% of Lannin's circumareolar experience but in only 8% when a radial elliptical excision was used (Donald Lannin, MD, e-mail communication, October, 2021). Dixon reported ipsilateral re-excision in 1 of 43 patients (2%) using a circumareolar incision.

After the publication of Lannin's series in 2004, the author adopted radial elliptical excision as the routine surgical approach for these patients. The primary reason for that choice is the ability to better obliterate the dead space and allow primary healing of a closed surgical wound. Three years after adopting that approach, results were reviewed in preparation for a talk at the annual meeting of the American Society of Breast Surgeons (see **Table 1**). Eighteen patients had radial elliptical incisions, and all healed primarily without wound complications. One patient (6%) recurred in another area of the ipsilateral areola and healed primarily after a second radial elliptical excision (unpublished data). The author's results over the next decade mirrored those obtained during the three-year period, but records are not available for review.

Radial elliptical excision

Radial elliptical excision is an outpatient procedure and is best conducted during a quiescent period when there is no active infection or inflammation. There are no

Table 1
Healing and recurrence rates for primary wound closure according to incision type

Author/ Year	Procedures	Incision	Primary Healing	Ipsilateral Recurrence/ Re-Excision
Dixon 1991	43	Circumareolar	39/43 (91%)	1/43 (2%)
Lannin 2004	8	Circumareolar	5/8 (62%)	2/8 (25%)
Lannin 2004	26	Radial elliptical	26/26 (100%)	2/26 (8%)
Snider 2008	18	Radial elliptical	18/18 (100%)	1/18 (6%)

studies specific to ZD to guide perioperative antibiotic usage. Because of the possibility of viable bacteria persisting in the tissue or fistulous tract, these operations should not be considered to be clean. The author started trimethoprim-sulfamethoxazole and metronidazole 24 hours before the operation and continued both for 7 days afterward. With 100% primary wound healing, it was difficult to rationalize the modification of the regimen to see if equal success could be achieved with a shorter course of antibiotics.

If a fistulous opening is present at the border of the areola, a lacrimal probe is passed from the opening out through the central portion of the nipple or vice versa (**Fig. 6**). Note the white keratin alongside the probe in the image. A surgical marker is used to outline an ellipse beginning just beyond the fistulous opening and extending up onto the central part of the nipple. If no fistula is present, one can usually feel an indurated area where the pathology is located and can draw a similar ellipse around the area of induration and up onto the nipple.

If a lacrimal probe is successfully inserted, it serves as a good "handle" to elevate the tissue and give traction for dissection. An incision is made in the elliptical markings with a scalpel, then electrocautery is used beneath the skin. The process is superficial, and there is no need to dissect deeply into the breast tissue. It is usually easy to distinguish chronically scarred tissue from normal tissue, and the dissection should be at that junction without any effort to get a wide margin around the scarred or inflamed tissue.

ZD is a multi-duct process, and any attempt to limit the dissection in the nipple to a single duct is ill-advised and invites recurrence in a separate quadrant. Most, if not all, of the ducts in the central core of the nipple, can be removed along with some overlying "skin," leaving a rim of the peripheral part of the nipple to be reconstructed.

Once the specimen (**Fig. 7**) is removed, the author's preference is to irrigate the wound with dilute povidone-iodine solution to reduce the chance that viable bacteria survive in the wound, a technique also recommended by Zhang.[26] Irrigation with saline then removes the povidone-iodine before closure. The wound is closed completely without drains or wicks, taking care to obliterate the dead space with absorbable sutures. Particular attention needs to be paid to nipple reconstruction whether a cleft had been present or not. A suture should be placed at the base of the nipple

Fig. 6. Note the white keratin beside the entrance of the lacrimal probe into the nipple. The probe is useful as a retractor to put the tissue planes under tension for dissection. During nipple reconstruction, it is important to approximate points A and B at the base of the nipple to ensure nipple elevation and symmetry.

Fig. 7. The specimen is removed en bloc with the probe passing through the fistula (if present). The superficial nature of the process does not require the removal of a large amount of tissue.

reapproximating the cut edges where the ellipse came onto the nipple (see points A and B in Fig. 6). This suture is helpful in ensuring nipple protrusion and symmetry. The remainder of the nipple should then be closed in a manner that ensures that it protrudes. Nonabsorbable interrupted sutures that go deep enough to obliterate nipple dead space work well but require removal. A separate purse string suture might be necessary immediately beneath the nipple in some cases to prevent inversion. Within a few weeks, the nipple will have a relatively normal appearance despite the removal of the central ducts (Fig. 8).

If a nipple cleft is present, the inverted portion of the nipple should be excised, again leaving ample peripheral nipple for reconstruction. The excision is easy to accomplish if the indurated area or fistulous tract extends in a plane along the longitudinal axis of the crevice (Fig. 9). The elliptical markings encompass the inverted portion of the nipple. If the indurated area or fistula is at right angles to the crevice, the ellipse can stop at the base of the nipple and extend linearly up the side of the nipple to give exposure to the inverted portion which is to be removed (Fig. 10).

Fig. 8. The linear scar extends from the breast beyond the previous fistulous opening up onto the anterior surface of the reconstructed nipple. Note the symmetry and protrusion of the nipple. Over time the scar fades and becomes less noticeable.

Fig. 9. Incision lines for radial elliptical excision Note the extension of the incision line along the edges of the nipple cleft which is parallel to the plane of excision.

Future Directions

It has recently been proposed that the etiology of ZD might be a chronic inflammatory process of the pilosebaceous follicles in the periareolar region similar to hidradenitis suppurativa, rather than distal obstruction from keratin plugging, and an alternative treatment was studied.[52] Eighteen fistulas were treated with ultrasound-guided percutaneous needle electrolysis which produces a nonthermal electrochemical reaction that releases caustic sodium hydroxide molecules that lead to localized tissue ablation. The authors reported success in 88% of patients, although multiple treatments were frequently required, and the follow-up was relatively short. The high degree of

Fig. 10. Incision lines for radial elliptical excision Note the incision must be modified if the nipple crevice is perpendicular to the plane of excision.

success in procedures that remove the terminal ducts and the high failure rate for procedures that do not remove the terminal ducts or correct a cleft nipple argue against the long-term success of the new procedure. More studies are needed before it can be considered a treatment option at this time.

PERIPHERAL NONLACTATIONAL ABSCESS

Peripheral nonlactational breast abscesses are similar to soft tissue abscesses that occur elsewhere in the body. The incidence is increased by obesity and diabetes, and the most common organism is *Staphylococcus aureus*. Resistant forms are becoming increasingly more common. These abscesses generally respond to antibiotics and aspiration or drainage, and the risk of recurrence is generally low. Lam, and colleagues,[53] extensively reviewed the literature concerning the proper management of breast abscesses and concluded that needle aspiration with or without ultrasound guidance should be the first method of treatment in addition to antibiotics. Their recommendation was based on the avoidance of general anesthesia, superior cosmetic results, and a shorter healing time compared with incision and drainage. Multiple aspirations over a period of days were often necessary, and larger abscesses sometimes required percutaneous catheter placement.

SUMMARY

Peripheral nonlactational abscesses behave like other soft tissue abscesses and resolve with drainage and antibiotics. Recurrence is uncommon. Subareolar abscesses tend to recur or to develop fistulae between obstructed ducts and the border of the areola and are usually seen in women in their thirties who have a history of smoking or a congenitally cleft nipple. The underlying cause of subareolar abscesses and fistulae is the obstruction of terminal ducts due to keratin plugging secondary to squamous metaplasia of the ducts. Successful resolution of the problem requires excision of the terminal ducts in, and just below, the nipple along with the correction of nipple deformity, if present.

CLINICS CARE POINTS

- Peripheral nonlactational abscesses respond well to antibiotics and drainage with a low risk of recurrence.
- Failure to excise the keratin-obstructed terminal lactiferous ducts will lead to a high risk of recurrence of subareolar abscesses and fistulae.
- The offending ducts can be removed with a circumareolar incision or with a radial elliptical excision, closing the wound primarily without wicks or drains.
- There is no need to require the patient to stop smoking before proceeding with a definitive operation during a quiescent period.

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