Journal on Oncology

www.journalononcology.org

Review Article

Open Access, Volume 3

Techniques for Diagnosis and Treatment of Pathological Nipple Discharge

Yinguang Gao[1]*; Qing Wang[2]

[1]Department of General Surgery, Beijing Friendship Hospital, Capital Medical University, Xi Cheng District, 100052, Beijing, China.

[2]Department of Medical Biochemistry and Microbiology (IMBIM), Biomedical Center (BMC), Uppsala University, 75123, Uppsala, Sweden.

Abstract

Nipple discharge is recognized as the third most common breast symptom, following breast pain and lumps. Although it is related to benign diseases mainly, an incidence of 5% to 12% associated with breast carcinoma still occurs. An entire procedure, therefore, of evaluating nipple discharge starts from historical inquiry and physical examination. Combined with diagnostic techniques, can Pathological Nipple Discharge (PND) be differentiated from physiologic incurrence; firstly, define the BI-RADS rating and explore causative disease. Further surgical diagnosis and treatment of ultrasound-guided Vacuum-Assisted Breast Biopsy (VABB) have gained wide acclaim in managing breast pathology delivering desirable outcomes in removing benign lesions or early detection of malignant diseases. This review describes an entire diagnosis and treatment process for PND patients via advanced techniques clinically.

Keywords: Nipple discharge; Pathological nipple discharge (PND); Diagnosis techniques; Ultrasound-guided device; Vacuum-assisted breast biopsy (VABB).

Introduction

Nipple discharge or breast discharge, as one of the most general complaints incurred by breast-related diseases different from other symptoms such as breast pain and breast lumps, presents particularly common in women patients aged 30-50 with an incidence of 4.8%-7.4% [1,2]. The dominating etiology of incurring Pathologic Nipple Discharge (PND) is a benign papilloma, with an incidence of 52%-57% [3-5]. Duct ectasia is another of the most common benign causes of PND, representing approximately 14%-33% of the cases [3], while breast cancers such as Ductal Carcinoma in Situ (DCIS) take up 5%-15% of cases of pathologic nipple discharge. In addition, breast infections, including periductal mastitis and breast abscess, are also incurring etiologies [6-9]. Due to its possible relevance for breast cancer, PND has posed significant attention regarding its significance of excluding deterioration if immediate diagnostic modalities and operative treatment are performed accurately and efficiently. Nowadays, the techniques for diagnosing the incurrence of PND focus on mammography, routine sonographic examination and Contrast-Enhanced Ultrasound (CEUS), mammary fiberoptic ductoscopy, and Magnetic Resonance Imaging (MRI) to find the most efficient and accurate diagnostic strategy for a better decision [10]. These methods are also enhanced by the novel technique device Vacuum-Assisted Breast Biopsy (VABB) guided by ultrasound as a minimally invasive approach in breast puncture for evaluating the qualitative diagnosis and effective treatment. Given the cost efficiency and state-of-art techniques availability of Sono Vue Contrast-Enhanced Ultrasound (CEUS)-guided VABB, this project review has summarized the illustrative terminologies and diagnostic imaging techniques used in these methods.

Manuscript Information: *Received: Oct 11, 2023; Accepted: Nov 02, 2023; Published: Nov 09, 2023*

Correspondance: *Yinguang Gao, Beijing Friendship Hospital, Capital Medical University, 95 Yong-an Road, Xicheng District, Beijing, 100050, China. Email: gaoyinguang@gmail.com*

Citation: *Gao Y, Wang Q. Techniques for Diagnosis and Treatment of Pathological Nipple Discharge. J Oncology. 2023; 3(2): 1112.*

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Indications and classifications of nipple discharge

What is nipple discharge, and what has caused it?

Nipple discharge is generally classified as breast discharge in normal conditions like physiological discharge and abnormal conditions such as galactorrhea and pathologic nipple discharge founded on their exhibiting characteristics and causes of presentation [2].

Physiological/benign discharge

The benign occurrence of discharge refers to physiological lactation commonly, including milk and colostrum production, or sometimes with external stress incurring some drops of sticky or dark-colored viscous fluid that are normal for the process of mammogenesis or lactogenesis during the puerperal period. The physiological discharge is responsive to a series of hormonal regulations and external physical or biochemical stimuli-induced hormonal secretion [2,10].

Nonpuerperal galactorrhea/abnormal discharge

Galactorrhea is not an indication of primary breast pathology compared to pathological nipple discharge. However, it refers to nonpathological nipple discharge during the nonpuerperal period, generally after more than 1 year of breastfeeding. Galactorrhea is mainly manifested as bilateral milky secretion and, in a few cases, as unilateral with light-colored discharge except when it contains blood. This abnormal circumstance is associated with the improper escalation of prolactin release (hyperprolactinemia), which could be secondary to medications of several pharmacological categories, including hormones, psychotropics, and antihypertensives. It can also be caused by other pathological changes such as pituitary adenoma, endocrine disorders such as hyperthyroidism, hypothyroidism, and renal failure, as well as other breast stimulation or chest complications [2].

Pathological Nipple Discharge (PND)

Pathological Nipple Discharge (PND) is a breast-related disease's most significant aberrant symptom. It is characterized by sanguineous, blood-stained, or serous-like (transparent or colored) fluid secretory production rather than regular milk lactation with the occurrence unilaterally within a single duct orifice of the nipple. Although the color of breast nipple secretory fluid functions as the alarm bell for further clinical evaluation, it never makes a decisive diagnosis to differentiate the benign from malignance, even if it indicates PND [2,10]. The common etiologies with which it correlates are described below:

Intraductal Papilloma (IDP): The benign papillary tumor is the most common cause of PND, especially for non-pregnant or nonpuerperal females with the apparent indications of presenting sanguineous discharge without the palpable mass [2]. This lesion is growing intraductal and adherent to the mammary duct wall localizing near the nipple orifice, occasionally concealing the malice existence of atypia or Ductal Carcinoma in Situ (DCIS) [10]. According to diagnostic imaging studies for judging PND with routine diagnostic investigation approaches, the papillomas' detection sensitivity in mammography was 62.9%, in sonography 72%, and in ductoscopy 86.6% [11].

Duct ectasia: Mammary duct ectasia (MDE) is the second most common benign etiology causing PND, which can be present in 15% to 20% of the patients who have suffered from nipple discharge [10,12]. Women over 50 could be most affected during the perimenopausal phase or postmenopausal period with indications of white, green, black, or grey-colored nipple discharge unilaterally or bilaterally, and even breast pain or tenderness [2]. This is a non-proliferative and non-invasive inflammatory disease characterized by focal dilatation of endoluminal lactiferous ducts filled with keratin obstructions or thick clogged secretions, as well as changes in duct wall elastin. This abnormal condition consequently leads to chronic inflammation and periductal fibrosis [2,9,10]. MDE could overlap some clinical manifestations in benign conditions such as periductal mastitis. Magnetic Resonance Imaging (MRI) also appears as a module of enhancement, similar to DCIS presents [9]. Thus clinical imaging assessment or even biopsy and histopathologic examination of the excised tissue are required to decide the differential diagnosis.

Breast carcinoma: DCIS is a heterogeneous group of intraductal tumors forming neoplastic lesions from the lining of breast mammary ducts and lobules. Sometimes DCIS occurs together with PND [13]. However, it is the least likely incurring cause among the three primary etiologies for PND, and particularly concomitant with a palpable mass, PND may thus be regarded as an alarm sign which is of significance in cancer detection [10].

Breast infection: Infectious diseases linked to PND mainly concern breast periductal mastitis and abscess formation. The clinical indications are multi-colored discharge, swelling, redness or tenderness, and even fever in some cases. Imaging modalities, e.g., sonography, can present the purulence as a hypoechoic lump or multiloculated fluid with a rim of thickness and echogenicity. The treatment focuses on empiric antibiotics, surgical drainage, and abscess excision [14].

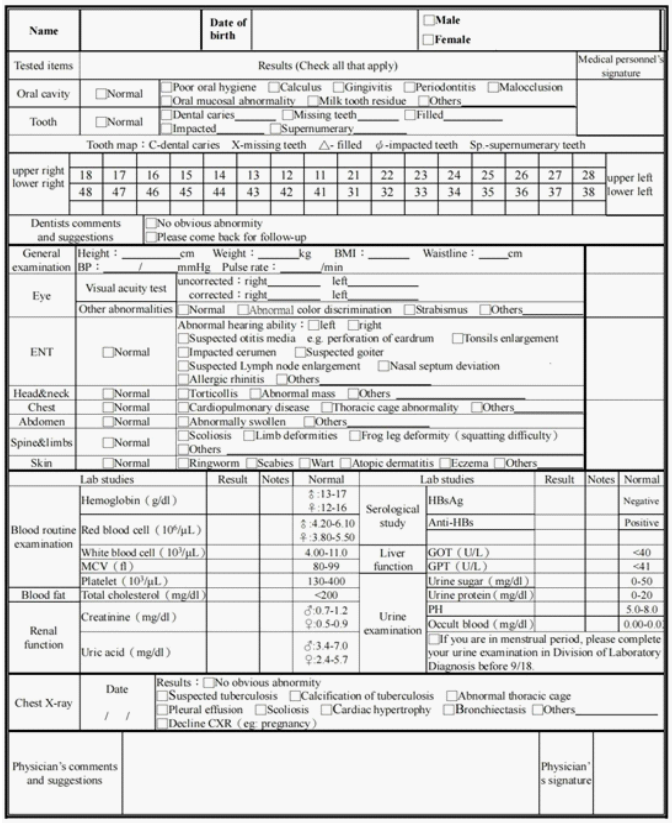
Diagnostic imaging modalities

What are the current diagnosis techniques? How do imaging studies help clinicians?

Initial clinical evaluation of a thorough history inquiry and proper physical examination is required in all female patients who have suffered from non-lactational nipple discharge [2]. The history inquiry has contained several factors related to prior medical conditions of patients with PND to define if there is a history or not that could have an impact on current clinical manifestations (Figure 1), while a physical examination is to examine the main parts from head and neck, torso and four limbs including blood routine examination to get a general realization for the general conditions of patients in case of any other incurrences (Figure 2). Apart from initial clinical evaluation, it starts from standard imaging diagnostic evaluation of conducting mammography to reveal physiological discharge or pathological discharge. Afterward, patients with PND will need further up-to-date and most commonly available imaging diagnostic investigation in a step-wise approach of sonographic examination, ductoscopy, and MRI to determine the explicit benign findings or malignancy suspect. For instance, galactography/ductography, cytological smear, and biopsy are not widely used during clinical diagnostic appraisal, particularly for galactography. The latter methods will be conducted only for further suspicion of cancer probability of malignant conditions. Furthermore, clinical imaging findings for diagnosing patients with

PND symptoms can vary depending on the potential etiology and imaging strategic methods [15].

Figure 1: Critical factors of the history inquiry process.



Name		Date of birth		☐Male ☐Female	
Tested items	Results (Check all that apply)				Medical personnel's signature
Oral cavity	☐Normal	☐Poor oral hygiene ☐Calculus ☐Gingivitis ☐Periodontitis ☐Malocclusion ☐Oral mucosal abnormality ☐Milk tooth residue ☐Others			
Tooth	☐Normal	☐Dental caries ☐Missing teeth ☐Filled ☐Impacted ☐Supernumerary			
Tooth map：C-dental caries X-missing teeth △- filled ϕ-impacted teeth Sp.-supernumerary teeth					
upper right / lower right	18 17 16 15 14 13 12 11 / 48 47 46 45 44 43 42 41	21 22 23 24 25 26 27 28 / 31 32 33 34 35 36 37 38			upper left / lower left
Dentists comments and suggestions	☐No obvious abnormity ☐Please come back for follow-up				
General examination	Height：___cm Weight：___kg BMI：___ Waistline：___cm BP：___/___mmHg Pulse rate：___/min				
Eye	Visual acuity test	uncorrected：right___ left___ corrected：right___ left___			
	Other abnormalities	☐Normal ☐Abnormal color discrimination ☐Strabismus ☐Others			
ENT	☐Normal	Abnormal hearing ability：☐left ☐right ☐Suspected otitis media e.g. perforation of eardrum ☐Tonsils enlargement ☐Impacted cerumen ☐Suspected goiter ☐Suspected Lymph node enlargement ☐Nasal septum deviation ☐Allergic rhinitis ☐Others			
Head&neck	☐Normal	☐Torticollis ☐Abnormal mass ☐Others			
Chest	☐Normal	☐Cardiopulmonary disease ☐Thoracic cage abnormality ☐Others			
Abdomen	☐Normal	☐Abnormally swollen ☐Others			
Spine&limbs	☐Normal	☐Scoliosis ☐Limb deformities ☐Frog leg deformity（squatting difficulty） ☐Others			
Skin	☐Normal	☐Ringworm ☐Scabies ☐Wart ☐Atopic dermatitis ☐Eczema ☐Others			

Lab studies		Result	Notes	Normal	Lab studies		Result	Notes	Normal
Blood routine examination	Hemoglobin（g/dl）			♂:13-17 ♀:12-16	Serological study	HBsAg			Negative
	Red blood cell（10^6/μL）			♂:4.20-6.10 ♀:3.80-5.50		Anti-HBs			Positive
	White blood cell（10^3/μL）			4.00-11.0	Liver function	GOT（U/L）			<40
	MCV（fl）			80-99		GPT（U/L）			<41
	Platelet（10^3/μL）			130-400	Urine examination	Urine sugar（mg/dl）			0-50
Blood fat	Total cholesterol（mg/dl）			<200		Urine protein（mg/dl）			0-20
Renal function	Creatinine（mg/dl）			♂:0.7-1.2 ♀:0.5-0.9		PH			5.0-8.0
	Uric acid（mg/dl）			♂:3.4-7.0 ♀:2.4-5.7		Occult blood（mg/dl）			0.00-0.0
						☐If you are in menstrual period, please complete your urine examination in Division of Laboratory Diagnosis before 9/18.			

Chest X-ray	Date / /	Results：☐No obvious abnormity ☐Suspected tuberculosis ☐Calcification of tuberculosis ☐Abnormal thoracic cage ☐Pleural effusion ☐Scoliosis ☐Cardiac hypertrophy ☐Bronchiectasis ☐Others ☐Decline CXR（eg. pregnancy）
Physician's comments and suggestions		Physician's signature

Figure 2: Physical examination routine form.

Mammography

Mammography, as the front-line clinical diagnostic imaging modality for breast disorders usually followed by sonography/ultrasound, is still practically recommended as a crucial instrument of starting-point investigation and diagnosis for patients with PND to rule out the malignant possibility of breast lesions given that it has the medium relative radiation level (01-1 mSv) compared to other imaging modalities such as sonography and MRI without radiological absorption [16]. The principle of it is to conduct low-energy X-rays (30 kVp) of ionizing radiation to create visualized images typically for detecting breast lumps or micro calcifications characteristically [17]. Following a meta-analysis study of collecting 36 studies of 3764 patients who have accepted the mainstream imaging diagnosis in terms of detection of malignity lesions, mammography has shown the highest average specificity with 93% and lowest sensitivity with 22% as well as the highest value in positive predictive value with 46% but diagnostic accuracy rate of medium ranking with 76% compared to the highest value of ductoscopy with 88% [18] which is to some extent qualified to identify the patients in PND without high-risk lesions or carcinoma in breast indicating whether the subsequent imaging studies are essentially required. Criteria (Figure 3), as a dividing line between benign and malignity in breast lesions with breast imaging reporting and interpretations from not only applying to mammography but also including ultrasound and MRI, is referring to ACR BI-RADS® (American College of Radiology, Breast Imaging-Reporting, and Data System) [19], which is a general risk appraisal and quality control lexicon to be designed to standardize breast diagnostic studies: it has been categorized to seven assessment classifications while BI-RADS 0-III considered as benign conditions. In contrast, BI-RADS IV-VI is considered suspicious malignant or proven malignancy [20]. However, findings of morphologic changes on mammography are prone to be detected better, ranging from normality to retro areolar dilated ducts, structural distortion and asymmetry, periductal micro calcifications, inverted nipple, and breast mass but not for cancer and comprehensively intraductal detection.

Sonographic examination

The routine sonographic examination is a widespread technique in clinical imaging practice in the field of breast imaging, which is supplementary primarily to mammography, especially if the result of mammography is negative for patients with PND [21]

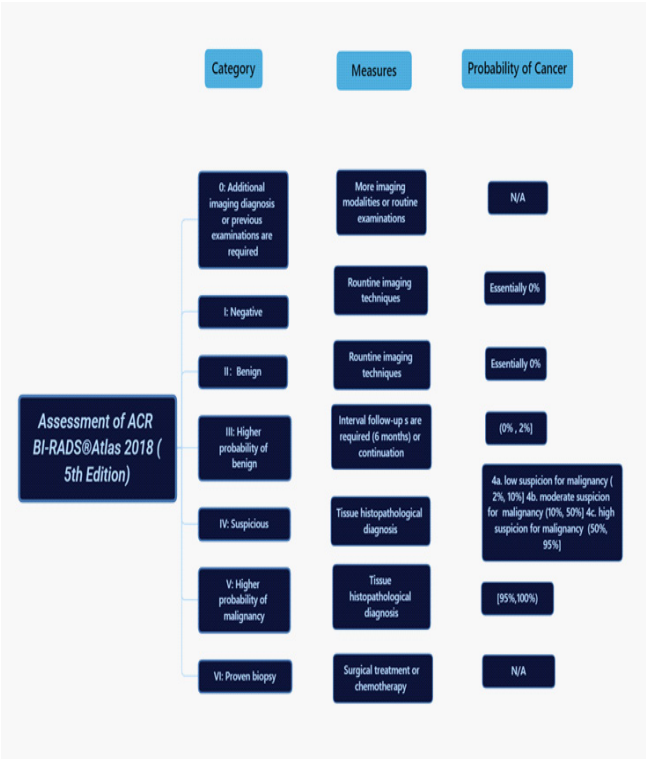


Figure 3: Final assessment of ACR BI-RADS® Atlas 2018 (5th Edition) (D'Orsi et al. 2018).

and has earned wide recognition due to its characteristics of noninvasive and free of ionizing radiation and even rated and ranked highest in clinical imaging scenarios with its features of criteria according to Lee et al. review of ACR Appropriateness Criteria® Evaluation of Nipple Discharge [16]. As for the malignity detection in patients suffering from PND, sonography presents a sensitivity of 50%, specificity of 69%, positive predictive value is 31% and negative-positive value is 83% [18]; among other imaging modalities, its performance is not as satisfactory as other specific features, but it is still recommended for diagnosis for some benign conditions such as intraductal papilloma causing intraductal nodule and ductal ectasia which are the first two significant etiologies causing PND [22]. It also takes advantage of detecting palpable or non-palpable breast mass and the involved ducts. If a mass is detected via physical examination or mammographically identified, it would be better to investigate if it is solid, cystic, or intraductal [15]. The routine ultrasound has the modes of chromatic doppler ultrasound with Color Doppler Flow Imaging (CDFI) and Color Doppler Energy (CDE) to observe the blood flow and distribution, while chromatic doppler could exhibit larger blood vessels and higher blood flow velocity but not microvessels then switch to Contrast-Enhanced Ultrasound (CEUS) probe and compression coupled with contrast agent (sulful hexafluoride microbubbles such as Sono Vue, diameter is tiner than erythrocytes) administrated intravenously could show the perfusion of capillaries in tissues or lesions with a distribution of microbubbles in microvessels with a better visualization of detected mass or even benign or malignant breast tumors since angiogenesis is significant for cancer metastasis, growth and invasiveness correlated to prognostic effect for which CEUS can provide better imaging and evidence for diagnosis (Figure 4) [23]. CEUS is quite essential and practical during necessary intraoperative procedures to guide minimally invasive microductectomy, namely the VABB technique.

Ductoscopy

Mammary ductoscopy is conventionally suggested and recommended for further investigation when mammogram and sonographic examination lacks the ability to diagnose the causative lesion or make a diagnostic conclusion of patients with PND even along with the therapeutic effectiveness for the treatment by laser ablation or mechanical clearance of intraductal lesions such as papillomas [15,24,25]. This invasive micro-endoscopic technique, free of ionizing radiation, is generally conducted with La Du Scope-T flex as the fiberoptic scope with an outer diameter of 1.0 mm under local anesthesia using diluted lidocaine (0.5%) for the povidone-iodine solution cleaned nipple-areola complex, from which can provide a real-time visualization access to the endolumenal lactiferous duct of the breast via cannulation of nipple unilaterally [25,26]. Aiming to identify where the part or complete intraductal lesion locates resulting in obstructed duct or mammary duct abnormalities (Figure 5), ductoscopy has been demonstrated as a secure and reliable technique to deal with these issues offering the strengths of lesion localization even in proximal terminal and preoperative guidance [2]. It is also showed that for the malignancy diagnosis the positive predictive value of ductoscopy is reported up to 41% following the highest value of mammography while its negative predictive value is exhibited as highest of 96% which is the same value as MRI, but it is has the highest diagnostic accuracy 88% than MRI in meta-analysis study with 3764 patients in 36 studies included [18]. This finding is also corresponding to a previous one of ductoscopy detection accuracy up to 94% for indicating malignancies in patients with PND [27]. Additionally, based on one study of exploring the follow-on satisfaction of patients with PND who has been performed with ductoscopy successfully has gained good result as an important predictor and even no impact on the quality of life of patients in PND over time [28].

Magnetic resonance imaging

MRI has been mostly recommended in recent studies as an emerging and preferred diagnosis instrument for screening high-risk patients with PND or detecting the primary origin of carcinoma [22,30] due to its strengths of being less invasive and no radiation especially when the findings of first-line imaging moda-

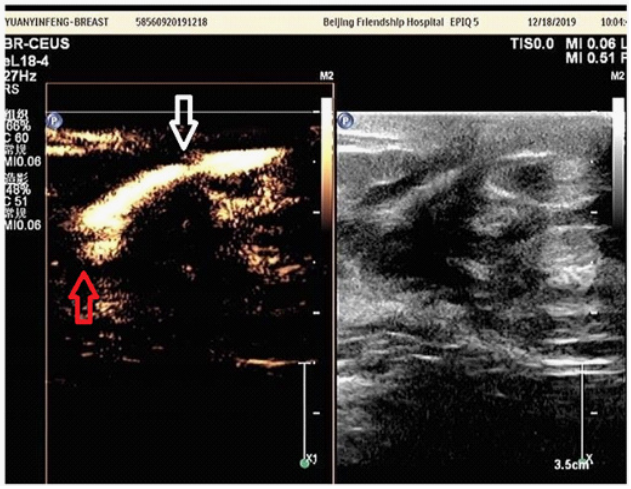


Figure 4: Shows highlighted ducts filled with the contrast agent of Sino Vue; filling stopped by red arrows and narrowed by white arrows taken as ductal nodule; B: Shows the image of routine ultrasound under the same probe.

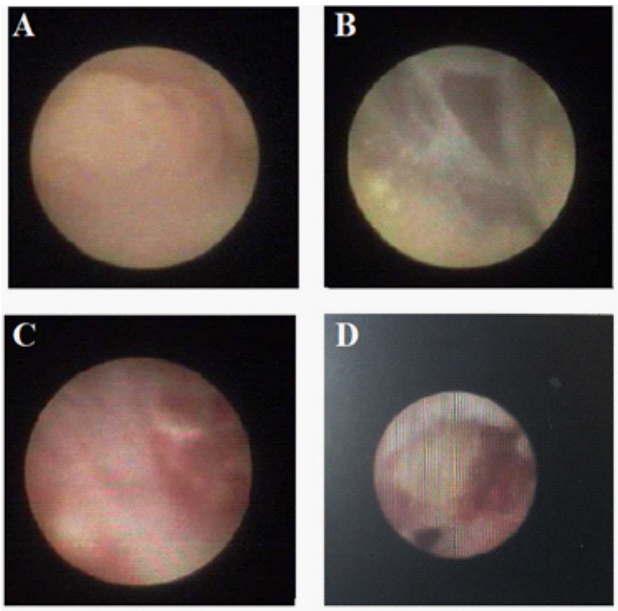


Figure 5: Intraductal visualizations via ductoscopic probe. (A) Intraductal nodule with white flocs attached to duct wall; (B) Intraductal lumen filled with yellow discharge and attached yellow particles; (C) Level II intraduct with rough duct wall congested with sanguineous edema; (D) Papillary lesion Thick hyperplastic diffusion [29].

lities of mammography and ultrasound are normal but the PND symptoms are not in resolution. Based on previous review, both of mammography and ultrasound techniques have limitations such as low sensitivity in etiology detection in terms of small lesions, not in calcifications conditions and locating retroareolar areas even its extent of scope [22,30,31]. From this, MRI can detect non-mass and mass enhancement (Figure 5) then even further conduct subcutaneous MRI-guided biopsy for histopathological diagnosis to rule out malignancy if surgery is essential [15]. According to Filipe et al. study of collecting 36 studies with 3764 patients in a meta-analysis regarding the detection of malignancy in patients with PND with diagnostic imaging techniques, MRI has shown the highest average sensitivity among others such as ductoscopy, ultrasound, cytology, and mammography of 83% followed by ductoscopy of only 58%, its specificity is 76%, positive predictive value is 40% while negative predictive value is highest as the same as ductoscopy of 96% with its diagnostic accuracy 77% [18]. Its highest diagnostic sensitivity for detecting the malignant probability of patients of PND has been demonstrated in many other types of research Nakahara et al. reported that MRI sensitivity is 100%, while among 22 malignancies it has demonstrated 7 cases of malignant lesions (4 DCIS) which other imaging modalities have not uncovered [30]; Lorenzon et al. has also stated that its statistically significant highest in sensitivity of 94.7% which malignant lesions only detected via MRI [32]. In Bahl et al. retrospective study of MRI in the evaluation of patients of PND, its sensitivity of 100% and specificity of 65% as well as NPV of 100% of MRI, has stated its promising reliability and is widely recognized [33]. Many other studies have illustrated MRI's highest sensitivity and NPV regarding PND syndromes [34-36]. The predictive values of PPV and NPV of MRI for high-risk lesions and carcinoma are highest at 56% and 87%, respectively, in Morrogh et al. study, which almost corresponds to the meta-analysis study [37]. However, its limitation has fallen into its higher cost and the false positive results which are reflected in case of incidental lesions unrelated to initial PND complaint as well as determining whether the lesion is incurring intraductal that more imaging diagnosis of mammography or ultrasound in a second look or ductoscopy detection are further indispensable [22,38].

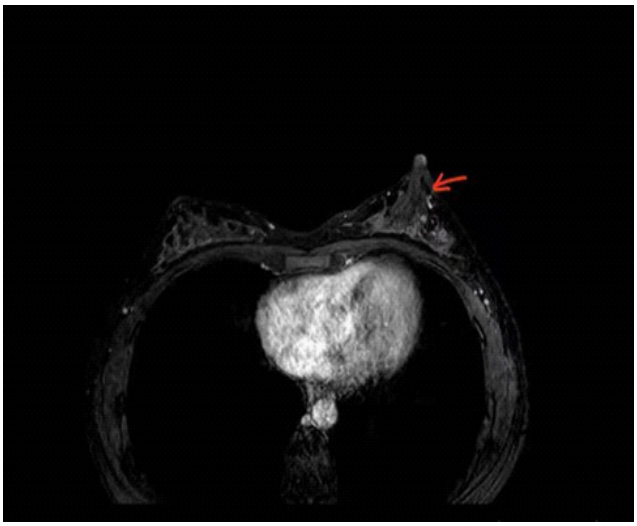


Figure 6: Left breast of PND in a 35-year-old woman of a filled gland in the left breast with increased T2WI signal and patchy delayed enhancement, classifying BI-RADS level III and diagnosing ductal ectasia while intraductal bleeding behind the nipple-orifice complex [39].

Surgical techniques: The pioneering technique diagnosis and treatment of PND.

Surgical anatomy: Breasts consist primarily of fatty tissue and parenchyma, located between the anterior chest wall superficial fascia and pectoralis central fascia [40]. There are 5-9 ductal orifices in the nipple central and peripheral region while 18-25 ducts behind the nipple-areolar complex, according to surgical anatomical cross-sectional studies, but merely 8-12 ductal orifices are lactating. Most are truncated without forming into formal lactiferous ducts connected with branching glands and generally terminated with a sebaceous gland near the areolar area. Larger ducts are distributed and branched widely into different quadrants within breast tissues. Optimizations of surgical approaches by surgeons could be facilitated by a more comprehensive realization of breast anatomy [41].

Anesthesia: General anesthesia or intravenous sedation for local anesthesia can be performed preoperative duct excision, given the nerve sensitivity of the nipple-areolar complex. Additionally, proper risk screening should be conducted before general anesthesia in patients [42].

Localization: Imaging modalities can be of direction to localize the lesions such as mammographic, ultrasound, galactographic, or ductoscopic guidance, among which intraoperative ultrasound localization or preoperative ductoscopy with an injection of the mixture of methylene blue and radiopaque dye are recommended that could provide a direct visualization imaging of stained lesions for better identification and operation [43-45].

Patients diagnosed with benign papilloma diseases without atypia transformation in biopsy could have a low-risk rate of suffering from malignant results; observations could be alternative to surgical treatment. However, in case of any risks of breast cancer occurrence, the corresponding treatments are essential required, for instance, drainage of the fluid-filled cyst via Fine Needle Aspiration (FNA), surgical operations via Vacuum-Assisted Breast Biopsy (VABB) of removing lumps and oral antibiotics administration of infectious breast inflammation [46].

Vacuum-Assisted Breast Biopsy (VABB) is a more novel and modernized technique for biopsy, diagnosis, and treatment related to breast diseases which were initially invented and developed by a radiologist named Fred Burbank and his colleague medical engineer Mark Retchard in 1995 in an attempt to overcome the weakness and increase the accuracy of core biopsies such as well-established Fine-Needle Aspiration (FNA) and Core-Needle Biopsy (CNB) that were popular in the 1980s and 1990s. One year later, VABB was created, and Burbank and his other colleague Parker introduced the stereotactic VABB as a diagnostic device for the evaluation of breast lesions visibly with the auxiliary imaging modality mammography [47,48]. Then in 1998, Zannis first conducted ultrasound-guided VABB, and gradually even MRI-guided VABB has been quantitatively applied to practical cases so far, both of which have avoided the possibility of radiation in terms of imaging modalities while the current equipment commonly used in intraoperative employment are Mammotome® VABB, SenoRx EnCor® VABB and XiShan Rotary® DK-B-MS. Additionally, compared to FNA or CNB and even conventional open surgical excision,

there are several studies have exhibited and stated that VABB obtains higher diagnostic accuracy as a safe, superior, and valuable technique for benign breast diseases and early breast cancer (ACR BI-RADS® III-IVa) for treating patients in PND, which is an ideal technique for diagnosis and therapeutic value [49-51]. Some studies employing ultrasound-guided VABB still have gained excellent results of more security, diagnostic effectiveness, and better prognosis [49,50]. In accordance with the meta-analysis research of Ding et al., including 15 types of research of 5256 patients who have been performed Mammotome-VABB and conventional surgical excision regarding the factors of the incision or scar size scar, operative time, wound recovery time, breast deformation and intraoperative hemorrhaging that VABB has demonstrated the apparent merits [51].

VABB system has three mainstream categories: stereotactic VABB, ultrasound-guided handheld VABB, and Magnetic Resonance Imaging (MRI)-guided VABB. It is a minimally invasive surgical technique composed of two structural modules: A vacuum pump and a rotary cutter. The vacuum pump is controlled by a computer software device that can maintain negative pressure to enable the rotational cutter to make suction on the lesion part and then facilitate biopsy sample collection automatically or manually. At the same time, a rotary cutter is designed with a hollow lumen with a groove that sucks on the corresponding resected lesions and completes the rotary excision process. VABB mainly contains three types of needles of different diameters that have been approved by the American Food and Drug Administration (FDA): 8G (250-310 mg), 11G (83-116 mg), or 14G (40 mg, twice than conventional biopsy gun) of which the most appropriate type is more dependent on the size of breast lesion since the volume differs then collecting sampling tissues varies each time with a single insertion. The most put into clinical application is ultrasound-guided VABB throughout the entire surgical process (Figure 7); the size of the skin incision merely needs 3-5 mm via puncturing the probe into the skin to reach the target lesion dyed in preoperative staining subcutaneously simultaneously guided by sonography positioning which could be access to the visualization underneath via high-resolution image on the monitoring screen. The features of accuracy and efficiency could be achieved via this device, thus reducing the possibility of sampling errors [48,50,51].

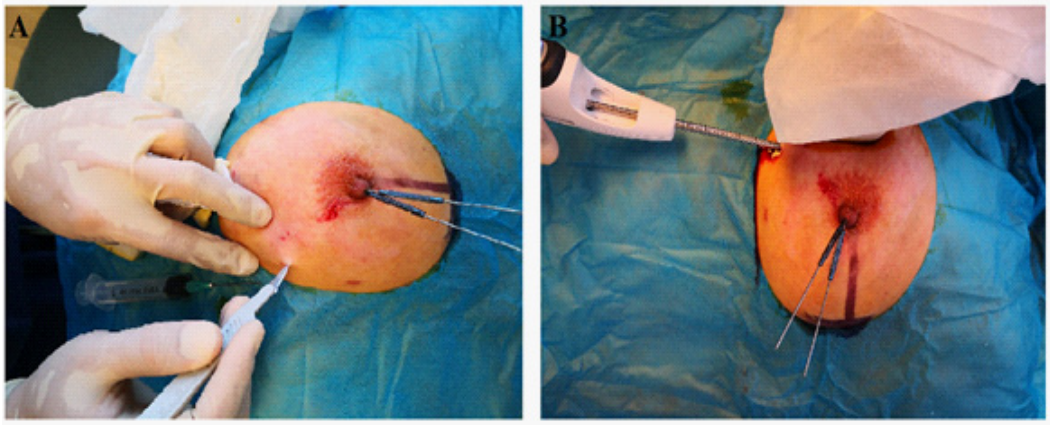


Figure 7: (A) Incision of 5 mm with the aid of scalpel for further Mammotome needle puncture; **(B)** 8 Gauge needle of the rotary cutter was punctured into the skin with an incision of a length about 5 mm. The sonographic probe was wrapped up in sterile medical gloves covered by gauze. Simultaneously enable, the rotary cutter was vertical to the long axis of the probe of sonography to be accessible to visualization of breast mass where the rotational cutter was inserted under mass subcutaneously for lesion removal via rotation of both of which till without residuals.

Discussion

Patients who have suffered from Pathological Nipple Discharge (PND) are required to obtain medical history primarily and perform physical breast examinations, given that factors are related to the probability of prognostic complications or worsening conditions. In contrast, physical examinations are required to detect breast symmetry or contour and noticeable physical changes like edema if there is a palpable breast mass [15]. If clinical manifestations of bloody discharge unilaterally and spontaneously still occur following the front-line diagnostic imaging modalities of mammography or routine ultrasound combined with Contrast-Enhanced Ultrasound (CEUS) to investigate the abnormalities or normalities and determine the BI-RADS for the early detection of benign lesions and malignant etiology. If there are normal conditions for which reassurance should be followed up or further to the next step for more auxiliary diagnosis to avoid false negative rate. The second-line imaging technique, such as ductoscopy, is for the visualization of intraductal conditions to define the etiology. At the same time, MRI is highly recommended to perform due to its highest average sensitivity for patients, particularly those who have not been investigated commonly in previous imaging modalities [18]. Selecting the most suitable diagnostic methods is required for the best strategy for diagnosis and treatment. Referring to the surgeon for surgical treatment has gained popularity for fewer residues of lesion removal and a more significant amount of contiguous samples collection via modernized Vacuum-Assisted Breast Biopsy (VABB) of ultrasound guidance via 8G or 11 G needle compared to 14 G and open conventional surgical incision to further diagnosis in histopathological examination in the reconfirmation of etiology and active measures for postoperative treatment if the detection is malignancy [52].

Conclusion

Initiating a thorough essential clinical evaluation of historical inquiry and physical examination enable clinicians to get first-hand materials of patients manifesting conditions of nipple discharge. The imaging techniques are essential in the early diagnosis and

detection in patients of Pathological Nipple Discharge (PND) preoperatively. Surgical intervention for the treatment of a sonography-guided Vacuum Assist Breast Biopsy (VABB) for lesions removal and specimens offering is a therapeutic, surgical technique of high efficiency, safe desirability, and valuable practicality.

Declarations

Conflict of interest statement: The authors have no conflicts of interest to declare.

Funding sources: The author did not receive funds.

Acknowledgment: As a result, we acknowledge the people mentioned above who have offered supportive assistance in our work from writing spur, which authors acknowledge.

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