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REVIEW

Management of high-risk (B3) breast lesions in symptomatic practice: evidence review and practical recommendations for multidisciplinary care

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Abstract

Borderline breast lesions (B3 lesions, also termed lesions of uncertain malignant potential or high-risk lesions) represent a heterogeneous group of entities associated with variable risks of malignancy. While the management of screen-detected B3 lesions has become increasingly standardised, no dedicated international recommendations exist for symptomatic B3 lesions, despite them posing a distinct clinical challenge. Symptomatic lesions differ from screen-detected lesions in their mode of presentation, lesion characteristics, biopsy techniques, and diagnostic objectives; consequently, management strategies derived from screening populations may not be directly applicable. This review summarises the current evidence and proposes a pragmatic management framework for B3 lesions encountered in the symptomatic setting (defined as those presenting with breast symptoms outside population-based screening programmes). This is particularly relevant for patients under 50 years of age, where the primary objective is to exclude malignancy at the index site rather than solely to stratify long-term cancer risk. Clinical-radiological-pathological concordance and multidisciplinary assessment are central to management decisions. Lesions presenting as palpable abnormalities (which are typically larger) or those demonstrating radiological-pathological discordance warrant a lower threshold for additional sampling or excision. Conversely, selected concordant lesions without atypia may be managed conservatively following adequate sampling. The long-term cancer risk associated with epithelial atypia should also be considered with subsequent risk-based surveillance implemented where appropriate. Overall, management requires a risk-adapted, multidisciplinary approach integrating pathological, radiological, and clinical factors alongside patient symptoms and quality-of-life considerations. Given the limited evidence, current recommendations rely on expert consensus and a proposed practical framework. They underscore the need for large-scale, high-quality studies with long-term follow-up to establish formal clinical guidelines.

Keywords B3 breast lesions · Symptomatic breast lesion management · Radiological-pathological correlation · Multidisciplinary approach · Vacuum-assisted biopsy · Vacuum-assisted excision

Introduction

A key limitation of percutaneous breast biopsy, including core needle biopsy (CNB) and vacuum-assisted biopsy (VAB), is potential under-sampling, whereby a malignant component is missed, and only associated benign changes are sampled, resulting in a benign but 'of uncertain malignant potential' (B3) diagnosis [1–7]. Although B3 is primarily a coding convention, these lesions are widely termed "high-risk lesions," "borderline lesions," or "lesions of

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uncertain malignant potential." However, increased subsequent breast cancer risk is mainly confined to lesions with epithelial atypia, whereas several other B3 entities are associated with a very low concurrent carcinoma risk [7–10]. B3 lesions constitute a heterogeneous group and can be clustered into four broad categories: (1) epithelial atypia, including atypical intraductal epithelial proliferation (AIDEP)/atypical ductal hyperplasia (ADH), lobular neoplasia (LN; atypical lobular hyperplasia (ALH) and classical lobular carcinoma in situ (LCIS), flat epithelial atypia (FEA), and apocrine atypia; (2) benign lesions that may harbour atypia or malignancy, such as papilloma and radial scar/complex sclerosing lesion (RS/CSL); (3) heterogeneous lesions, particularly cellular fibroepithelial lesions (FELs), which often require complete excision for definitive classification; and (4) miscellaneous lesions, including low-grade spindle cell lesions, adenomyoepithelioma, vascular lesions, granular cell tumours and others [11–13].

B3 lesions are most commonly encountered in population-based breast cancer screening, where concerns regarding both underestimation of malignancy and overtreatment of asymptomatic individuals drive management. Large retrospective and prospective studies have informed increasingly standardised screening pathways incorporating VAB, vacuum-assisted excision (VAE), selective surgery, and surveillance [10, 14–20]. However, the applicability of these pathways to symptomatic practice remains uncertain. Management in symptomatic patients is inherently more complex owing to greater heterogeneity in clinical presentation, a more limited evidence base, and the need to interpret pathological findings within the broader clinical (and radiological) context. Additional considerations include younger patient age, cumulative lifetime breast cancer risk, patient preference, and the absence of well-defined surveillance protocols. Follow-up imaging may also require individualisation, as magnetic resonance imaging (MRI) or contrast-enhanced mammography (CEM) may offer advantages over conventional mammography in selected younger women [21, 22].

Historical surveillance strategies for screen-detected B3 lesions with atypia were largely precautionary and based on evidence generated before the widespread adoption of VAB. Contemporary image-guided vacuum-assisted management has enabled a more selective and risk-adapted approach to follow-up. Data from the Sloane project suggest that annual mammographic surveillance may not be necessary for all patients with screen-detected atypia after adequate assessment and management, highlighting the need for more tailored follow-up strategies [23, 24]. However, the applicability of these findings to symptomatic practice remains uncertain [25].

Symptomatic lesions account for only 20–40% of B3 diagnoses, and epithelial atypia is proportionally less common than in screening populations, thereby limiting the available evidence base [26–30]. For example, a large single-centre series of 4,168 biopsies reported B3 lesions in 6.5% of symptomatic cases compared with 12.4% of screening cases, with atypia present in 30.2% and 56.4% of lesions, respectively [28]. Consequently, current management recommendations are largely derived from screening cohorts, although this distinction is often not explicitly stated, and no dedicated international guidelines address the management of symptomatic B3 lesions [10, 15, 16].

This review addresses the diagnostic, clinical, and management challenges of B3 lesions in symptomatic settings, including patients presenting outside structured screening programmes with symptoms (e.g. palpable mass, nipple discharge, pain, skin change) or undergoing opportunistic imaging based on clinical concern or perceived risk [31, 32]. The key differences between these settings are summarised in Table 1; Fig. 1. Given limited high-level evidence, recommendations are presented as an evidence-informed practical framework rather than as a formal guideline. Management of patients with equivocal C3 cytology associated with symptomatic B3 lesions is outside the scope of this review [33].

Clinical context: Screening versus symptomatic practice

Population-based screening programmes assess asymptomatic individuals to maximise early cancer detection while minimising unnecessary intervention. Most B3 lesions are asymptomatic and detected through screening as microcalcifications or impalpable imaging abnormalities. Management focuses on securing a definitive diagnosis while avoiding overtreatment and false negative diagnoses. In contrast, symptomatic practice involves a broader and more heterogeneous population, often including younger patients. Presentations include palpable masses, breast pain, nipple discharge, or skin changes. Small focal lesions or isolated microcalcifications, common in screening populations, may instead represent incidental findings on opportunistic imaging undertaken on women with symptomatic lesions in the breast. This group may also include patients assessed outside routine screening, such as those with a known high-risk genetic mutation, a family history of breast cancer or previous breast cancer, those undergoing imaging investigation in the setting of contemporaneous ipsilateral or contralateral breast cancer, and individuals presenting with a symptom between screening rounds [34, 35]. High-risk and interval

Table 1 Comparison of the clinical context and management principles for B3 breast lesions in screening and symptomatic practice

Feature	Screening setting	Symptomatic setting
Patient population	Asymptomatic individuals undergoing population-based screening	Patients presenting with breast symptoms or clinical abnormalities
Primary clinical objective	Early cancer detection while minimising unnecessary intervention	Identification of the cause of symptoms and diagnosis of the index lesion
Typical presentation	Microcalcifications, architectural distortion, asymmetries and small impalpable lesions	Palpable masses, nipple discharge, skin or nipple changes, imaging abnormalities associated with symptoms
Clinical significance of a B3 diagnosis	Frequently an incidental imaging finding	More likely to represent or be related to the presenting clinical abnormality
Clinicopathological-radiological concordance	Usually based on imaging findings alone	Requires close integration of clinical examination, imaging and pathology to ensure the biopsy adequately explains the presenting symptoms
Tolerance of minimal lesions on CNB	Higher; small incidental lesions may adequately explain imaging findings	Lower; minimal lesions may not account for symptoms, increasing concern for sampling error
Need for repeat biopsy	Less common	More frequent when clinicopathological-radiological discordance or inadequate sampling is suspected
Role of vacuum-assisted excision (VAE)	Central role; often provides definitive diagnosis and treatment	More selective role; often reserved for carefully selected concordant lesions
Role of surgical excision	Avoided where safe and supported by evidence	Lower threshold for surgical excision, particularly when symptoms persist or diagnostic uncertainty remains
Management of benign concordant lesions	Imaging surveillance is often appropriate	Surgery or additional intervention may be considered to alleviate symptoms despite benign pathology
Follow-up strategy	Standardised imaging surveillance according to screening protocols	Individualised follow-up based on symptoms, breast density, imaging findings and multidisciplinary assessment
Approach to diagnostic uncertainty	Conservative management with emphasis on avoiding overtreatment	Lower threshold for additional sampling, specialist pathological review and surgical management when uncertainty persists

CNB core needle biopsy

presentations overlap with symptomatic workflows but are not identical and are discussed separately; protocols for very high-risk family history patients are already in place [36, 37]. Accordingly, diagnostic uncertainty in these non-screening settings may have different clinical implications and often justifies a lower threshold for further investigation. As a result, diagnostic pathways, follow-up strategies, and multidisciplinary management may differ from lesions detected through routine breast screening practice.

Approach to diagnosis

In current practice, image-guided (typically ultrasound-guided) CNB is usually the first diagnostic step in evaluating a symptomatic lesion. Although symptomatic lesions are often larger and more accessible, initial sampling may not be representative and further imaging (repeat ultrasound, CEM, or MRI) and repeat biopsy (usually with VAB) may help to clarify the nature of the patient's presenting complaint and reduce the risk of underestimation.

A distinction should be made between diagnostic sampling procedures (CNB, VAB) and excisional techniques, including VAE and open surgical excision (diagnostic or therapeutic). CNB and VAB are primarily designed to obtain tissue for diagnosis, although VAB may incidentally achieve complete removal of small lesions depending on lesion size and the extent of sampling. In contrast, VAE is performed with the intention of completely removing of selected small lesions and therefore serves both diagnostic and therapeutic purposes. Surgical excision may be undertaken for either diagnostic or therapeutic reasons, depending on the clinical context. However, neither VAE nor diagnostic surgical excision guarantees complete lesion removal, particularly when the extent of the lesion is uncertain or multifocal. The relative roles of CNB, VAB, VAE and surgical excision are summarised in Supplementary Table 1.

In the UK and many European centres, CNB of B3 lesions may be followed by VAB for additional sampling or by VAE or surgery, using a stepwise approach, for excision and further evaluation [15]. VAE is the preferred minimally invasive technique when technically feasible and desirable [31, 32]. VAE is also valuable in symptomatic practice, although its role may be limited by larger lesion size or lesion type (e.g. cellular fibroepithelial lesions). In patients presenting with a mass, nipple discharge, or skin changes, small histological foci (0.1–2 mm range), often referred to in practice as "microfocal" abnormalities (e.g. ADH, ALH, classical LCIS, FEA), are more likely to represent incidental or co-existent findings, or part of a partially sampled higher-risk lesion. Depending on lesion size, histological findings and clinical context, open surgical procedures may be more frequent than in screening practice. If malignancy is identified on excision, patients proceed along standard oncological pathways. Where a benign diagnosis is established, further management should be guided by clinical symptoms and signs, patient preference, the estimated risk of continued lesion growth or progression, and the potential impact on future interventions.

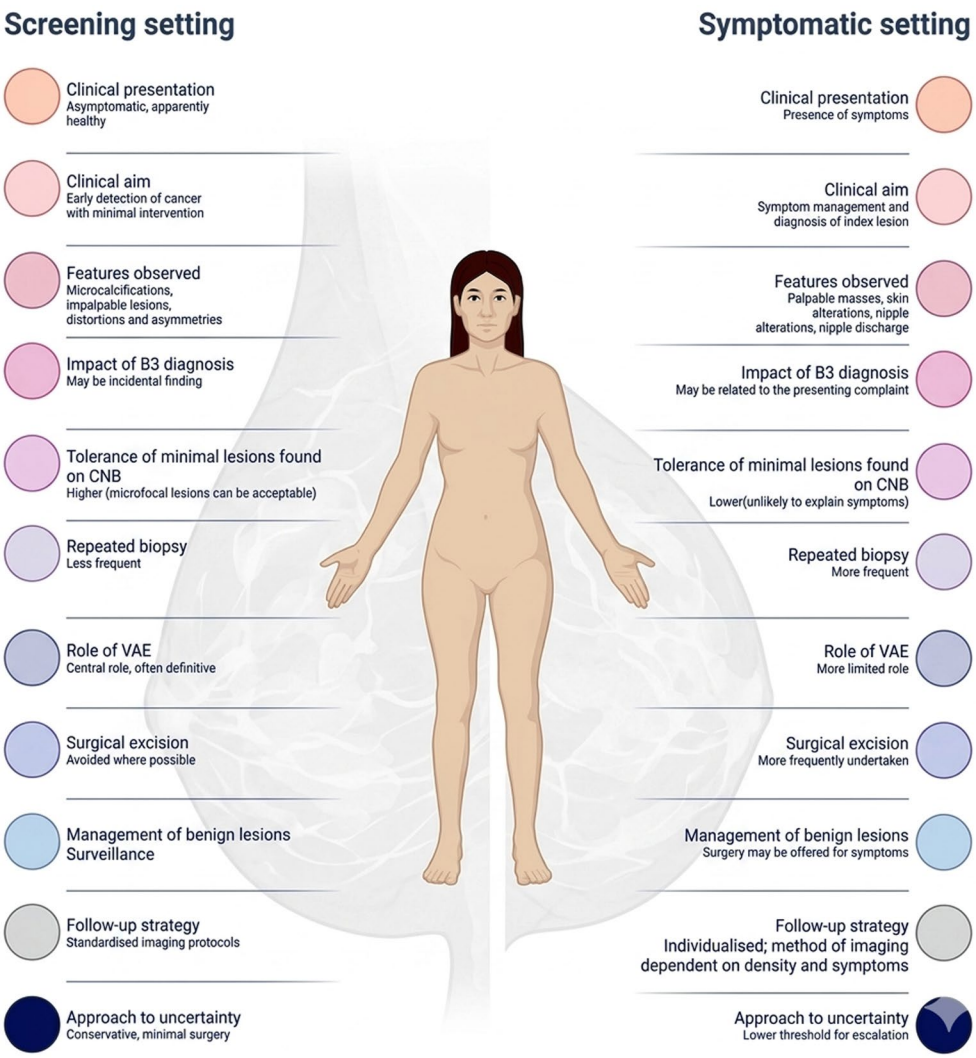


Fig. 1 Comparison of B3 lesion management in screening and symptomatic settings. Schematic overview highlighting differences in the clinical context, diagnostic approach, and management of B3 breast lesions detected through population-based screening versus those presenting with symptoms. Figure created using BioRender.com

Multidisciplinary assessment Given the complexity and heterogeneity of B3 lesions, multidisciplinary team (MDT) discussion is essential. Integration of pathological findings, imaging features, patient risk factors, symptoms, surgical and cosmetic considerations, comorbidities and patient preferences enables tailored management while balancing diagnostic uncertainty against the risks of under- or overtreatment. Shared decision-making remains central to this process. A B3 result in the presence of suspicious clinical (P4/P5) or imaging (BI-RADS 4/5) findings should raise concern in both settings and warrants further tissue sampling in some form for clarification. Moreover, given the well-recognised interobserver variability in the diagnosis of several B3 lesions [38–40], many laboratories routinely perform internal reviews or hold consensus discussions among breast pathologists for diagnostically challenging cases. Where uncertainty persists, particularly when the diagnosis may influence patient management, referral for specialist opinion should be considered as best practice. Such a review complements multidisciplinary assessment and may improve diagnostic consistency and patient care.

Diagnostic uncertainty and upgrade risk in symptomatic b3 lesions

Symptomatic B3 lesions, particularly those presenting with a clinically significant abnormality, are more likely to harbour significant pathology than screen-detected lesions [41–46]. Microfocal atypical lesions such as ADH but also FEA, ALH and classical LCIS, when associated with a discrete mass, are usually part of a more complex lesion or an incidental finding adjacent to the symptomatic abnormality [47].

Although some studies have reported similar upgrade rates in symptomatic and screen-detected B3 lesions, published data remain heterogeneous and largely retrospective, with variability in lesion definitions, biopsy techniques, and case selection [14, 26, 27]. In a comparative study, *Elsheikh*

et al. [28]. reported a higher positive predictive value (PPV) for B3 lesions with atypia in symptomatic patients (14%) than in screening patients (9.7%). The upgrade risk (i.e., identification of in situ or invasive carcinoma on subsequent sampling/excision) varies by lesion subtype (Table 2), which forms the basis for risk-adapted management strategies. Upgrade rates appear to increase with patient age, lesion size, mass-forming imaging features, biopsy method, and radiological–pathological discordance [18, 26, 27, 53]. Higher upgrade rates have also been reported following CNB compared with VAB, likely reflecting differences in sampling adequacy [8]. In patients with symptomatic B3 lesions, the risk of upgrade is also influenced by clinical presentation and baseline risk profile. Management decisions should be individualised and based on multidisciplinary assessment rather than uniform lesion-based algorithms alone. There remains no clear consensus regarding the indications for excision or the optimal extent of excision in many symptomatic B3 lesions [26, 54–57].

Long-term risk of malignancy in epithelial atypia

The distinction between upgrade risk at presentation (contemporaneous malignancy detected on further sampling/excision) and long-term (later progression) breast cancer risk is central to the management of symptomatic B3 lesions. Epithelial atypia is a recognised marker of increased future breast cancer risk [23, 48, 58] and may be best regarded as an indicator of field-wide susceptibility rather than as an obligate short-term precursor, with subsequent cancers arising many years later and affecting either breast [23, 29, 30, 59]. Importantly, early cancer events after modern VAB/VAE assessment are uncommon, and rates appear comparable to those after surgical excision, supporting the safety of contemporary minimally invasive management in selected concordant cases [23].

Meta-analyses and cohort studies report an approximately fourfold increase in long-term breast cancer risk after a histological diagnosis of atypia, with 5- and 10-year incidence varying by lesion type and biopsy techniques [23, 48, 60, 61]. The number of atypical foci may also influence the cumulative risk of developing breast cancer [58]. A retrospective single institution review of 58 women under the age of 35, with histologically confirmed atypia (ADH, ALH, LCIS), reported a 12% rate of subsequent breast cancer with a median time to a diagnosis of malignancy of 90 months (range 37–231). Patients who developed malignancy included 6 with invasive carcinoma and 2 with DCIS. The authors concluded that, in view of the high subsequent breast cancer risk, young women should be followed up closely [62]. A large study of 530 patients investigated the effect of age (under 50, 50–70 and over 70) on long term outcome of atypical lesions [63]. The incidence of ADH, but not lobular neoplasia, steadily increased with age. Older age was associated with a significantly higher risk of contemporaneous malignancy but was not associated with an increased long-term risk of developing subsequent cancer. A recent systematic review of 12 studies ($n=6252$ atypia) concluded that the currently available risk assessment models, including the Gail and Tyrer-Cuzick models, showed poor test concordance in risk prediction in patients with epithelial atypia. While the newer methods have improved calibration, further refinement and validation are required [64].

Management principles in symptomatic practice

Based on current evidence, the management of symptomatic B3 lesions broadly parallels that of screen-detected lesions but should be tailored to the clinical presentation, with a lower threshold for intervention in cases of radiological-pathological discordance, mass-forming lesions, or persistent symptoms. VAE is the preferred method of further sampling and lesion assessment for many B3 lesions, including those without epithelial atypia and selected atypical lesions. Surgical excision may be performed if VAE is not technically feasible (e.g. very superficial lesions or those close to the nipple) or if preferred by the patient. Surgical excision is also recommended where there is radiological-pathological discordance (e.g. a palpable mass not accounted for by the results of the CNB/VAB) and for the evaluation of some specific B3 lesions diagnosed on CNB (Fig. 2). Pure epithelial atypia (e.g. AIDEP/ADH, LN, FEA) may be managed by VAE or surgical excision, according to the UK and international guidelines for B3 management summarised in Shaaban et al. 2025 [65].

Surgical excision is recommended for the definitive diagnosis of cellular fibroepithelial lesions (FELs) which account for a significant proportion of B3 lesions in younger patients. Recent guidelines consider enucleation an appropriate treatment when the differential diagnosis of a B3 cellular FEL on CNB is between cellular fibroadenoma and benign phyllodes tumour (PT). However, if borderline or malignant PT is suspected, surgical excision with clear margins is recommended [66, 67]. Notably, an increasing number of studies have reported favourable outcomes following VAE of small cellular fibroepithelial lesions that are not upgraded beyond benign PT [68].

In symptomatic practice, radial scars (≤ 1 cm) and complex sclerosing lesions (>1 cm) are typically identified in association with clinical or imaging abnormalities [67]. Larger lesions may present as palpable masses, whereas smaller lesions are often incidental and not the direct cause of symptoms. Thorough sampling is essential, as larger lesions (e.g. >2 cm) may harbour unsampled malignancy

Table 2 Risk of upgrade of individual B3 lesions in the screen-detected settings [10, 14–16, 20, 23, 48–52] and proposed management strategy for symptomatic practice*

Lesion	% risk of upgrade	Risk of subsequent carcinoma	Recommendations for Screen-detected presentation	Suggested symptomatic management Strategy
ADH	22% (5–50%)	At 5-year: 4.8–6.6% At 10-year: 13.9%	° 1 st line management = VAE ° If rad-path discordance with only initial CNB OSE or VAE ° Discuss always in an MDT setting.	° Similar approach. ° After excision: risk-based management as per high-risk patient protocols
LN	27% (0–40%)	At 5-year: 5.4–8.6% At 10-year: 17%	° VAE if lesion is visible on imaging. ° If rad-path concordance with small (e.g., < 10 mm) adequately sampled lesion surveillance ° OSE discordance or presence of residual abnormality	° Same approach ° After excision: risk-based management as per high risk patient
ALH	12%	At 5-year: 9.7% At 10-year: 15.4%		
LCIS classical	22%	At 5-year: 9.3% At 10-year: 11.8%		
FEA	Varies according to whether associated atypical intraductal epithelial proliferation 11% (range 2–21%); or pure FEA: 5% (1–16%).	At 5-year: 3.2–3.8% At 10-year: 7.2%	° VAE is generally recommended to remove at least 90% of microcalcifications for thorough sampling. ° Surveillance may be considered for isolated concordant FEA without associated ADH. ° OSE if there is coexisting ADH or sampling is limited and there is rad–path discordance. ° Isolated FEA with almost complete removal and rad–path concordance no follow-up is required.	° Similar approach. ° The clinical significance of FEA in palpable breast masses such as papilloma or FELs remains uncertain and management in such cases should focus on the index mass lesion.
Multiple B3 lesions/mixed atypia (e.g. ADH + LN; atypia in FEL)		At 5-year: 7.8%	° Multiple B3 components increase uncertainty. ° OSE of the mass lesion with atypia is preferred but VAE is an option depending on variety of features.	° Surgery is generally more appropriate than VAE. ° If no upgrade and fully excised risk-based management may apply, dependent on histology.
Papillary Lesions	CNB: No atypia: 4–9%; with atypia: 20–36%. Lower rate when VAB		° VAE for IDP without concomitant ADH for diagnostic confirmation and potential therapeutic removal. ° If sampling is representative and rad–path concordance is achieved further excision may not be required. ° OSE for IDP with concomitant ADH because of the higher risk of associated carcinoma and the need to assess the extent (mm) of the atypia.	° Similar approach. ° May require OSE for control of symptoms (e.g. duct excision for nipple discharge)
Radial Scar/ Complex sclerosing lesion	No atypia: 0–10%. With atypia: 2–36%. Lower rate when VAB		° VAE aiming for thorough sampling/complete removal of the imaging abnormality is recommended. ° OSE should be considered when the lesion is large, or atypia is present or rad–path discordance exists.	° Same approach ° After excision if atypia present: risk-based management as per high risk patient
Cellular FEL	Risk is phyllodes tumour (PT)	Typically represents benign PT low risk of recurrence as malignant PT	° OSE to distinguish cellular fibroadenoma from benign PT. ° VAE can be attempted for small FEL lesions without features suspicious of borderline or malignant PT. ° If there is a risk of borderline PT–> OSE with a margin. ° Excised Benign PT: no imaging follow-up is needed.	° Same approach

Table 2 (continued)

Lesion	% risk of upgrade	Risk of subsequent carcinoma	Recommendations for Screen-detected presentation	Suggested symptomatic management Strategy
Adenomyoepithelioma (AME)	Benign: increased risk of LR compared to papilloma. Atypical AME: increased risk of LR and may develop lymph node metastasis	No data	° Classical AME–> OSE ° Atypical AME or histologically concerning features OSE with clear margins and MDT discussion. ° If completely excised and benign no imaging follow-up.	
Mucocele-like lesions (MLL)	Benign but hypocellular mucinous carcinoma or DCIS need to be excluded.		° VAE is preferred. ° If rad-path concordance is achieved and no atypia conservative management may be appropriate in selected cases. ° OSE if there is atypia or lesion is large and suspicious on imaging. ° MLL without atypia, adequately sampled and rad-path concordance no follow-up is needed.	° Similar approach. ° If NCB shows MLL and there is a palpable mass: VAE or OSE to exclude hypocellular mucinous carcinoma based on the size of the lesion and presence of any epithelial atypia.
Vascular Lesions			° Diagnostic surgical excision is typically advised but based on imaging/clinical and histological features and correlation. ° If benign no follow-up	
Fibromatosis	Locally infiltrative.	No cancer risk	° Watch and wait (soft tissue protocols) ° 1 st line OSE is not recommended unless patient choice for symptomatic cases.	
Myofibroblastoma and granular cell tumour	Benign lesion	No cancer risk	° OSE. ° If benign diagnosis confirmed on OSE No follow-up is required	

OSE open surgical excision, *rad–path* radiological–pathological concordance, *CNB* core needle biopsy, *VAB* vacuum-assisted biopsy, *VAE* vacuum-assisted excision, *FEL* fibroepithelial lesion, *PT* phyllodes tumour, *ADH* atypical ductal hyperplasia, *LN* lobular neoplasia, *ALH* atypical lobular hyperplasia, *LCIS* lobular carcinoma in situ, *FEA* flat epithelial atypia, *IDP* intraductal papilloma, *MLL* mucocele-like lesion, *AME* adenomyoepithelioma, *MDT* multidisciplinary team, *LR* local recurrence

* These are proposed management considerations, not formal guidelines, and management recommendations should be interpreted in the context of multidisciplinary assessment and individual patient factors and preference

despite the absence of epithelial atypia on CNB. Accordingly, further assessment by VAE or surgical excision, depending on lesion size, extent and technical considerations, is recommended. When the symptomatic target lesion has been completely removed by VAE or surgery, with radiological-pathological concordance, routine lesion-specific short-term imaging follow-up is generally unnecessary [23]. Clinical review is appropriate if symptoms recur. Where a concordant low-risk B3 lesion remains in situ (e.g. small RS/CSL without atypia), patients may be reassured and discharged or considered for limited interval imaging surveillance following MDT discussion. This approach also applies to patients with a diagnosis of papilloma without atypia on CNB. Surgical excision is the preferred method for evaluation of papillomas with epithelial atypia (AIDEP/ADH or LN). Diagnosis and management of papilloma with FEA remains uncertain [69, 70].

Screen-detected mucocele-like lesions (MLLs) without atypia typically carry a low risk of malignancy [71, 72]. In this context, imaging findings are often non-specific and variable; the most common presentation is incidental coarse heterogeneous calcifications on mammography. Occasionally, an asymmetry or mass may be detected with or without calcifications, and such lesions have a higher rate of upgrade to malignancy at excision [73]. When symptomatic MLLs present as a mass lesion, the absence of atypia on CNB may reflect sampling limitations, and VAE or surgical excision should be considered to exclude mucinous carcinoma [73].

Management of spindle cell lesions depends on the specific pathological diagnosis, as these represent a heterogeneous group. After exclusion of fibromatosis-like metaplastic breast carcinoma with application of a range of immunohistochemical markers, lesions should be managed individually with emphasis on diagnostic certainty rather than routine removal. Desmoid fibromatosis in the breast is a rare benign lesion typically presenting as a locally infiltrative symptomatic mass that can closely mimic malignancy clinically and radiologically [74–76]. Management of

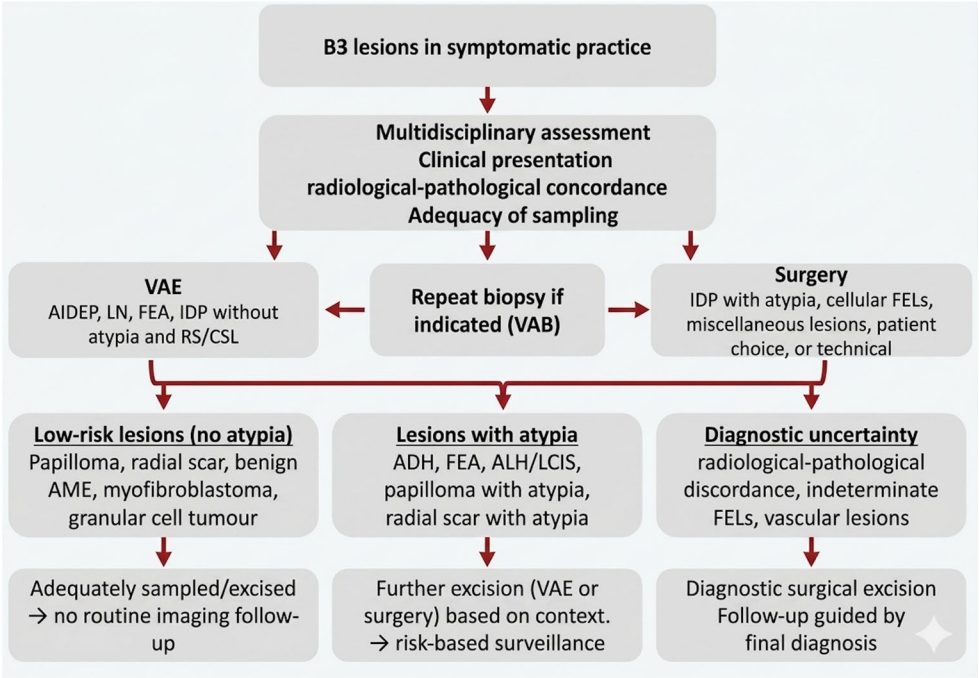


Fig. 2 Management of B3 lesions in the symptomatic setting. Schematic overview of risk-adapted management following a B3 diagnosis on core needle biopsy. Initial assessment includes multidisciplinary review, clinical presentation, radiological-pathological concordance, and adequacy of sampling. Management may include repeat biopsy (typically vacuum-assisted biopsy [VAB]), vacuum-assisted excision (VAE) for selected lesions, or surgical excision where indicated. Subsequent pathways are stratified into low-risk lesions without epithelial atypia, lesions with epithelial atypia, and cases with diagnostic uncertainty or radiological–pathological discordance, which are typically managed by surgical excision. Follow-up is guided by the final diagnosis, with risk-based surveillance considered for atypical lesions

desmoid tumours has shifted from primary surgical resection to a risk-adapted approach prioritising observation. Modern consensus guidelines, including those from the National Comprehensive Cancer Network (NCCN) and the European Desmoid Tumour Working Group, recommend initial observation for stable disease and reserve surgery for refractory or rapidly progressive cases [77–80]. This evolution acknowledges the high recurrence rates associated with surgical excision and the potential for spontaneous stabilisation. Accordingly, once the diagnosis of fibromatosis is confidently established on CNB (supported by typical histology, β-catenin staining and molecular analysis for *CTNNB1* or *APC* gene mutation where available) and malignancy has been excluded, management should be individualised through a specialist soft tissue MDT, balancing symptoms, lesion behaviour/progression, and patient preference.

Adenomyoepithelioma (AME) may be difficult to diagnose on CNB, but even if diagnosed on such limited sampling, it should be surgically excised to confirm the diagnosis and exclude more serious pathology, which may rarely be seen in the form of atypical or malignant features in either glandular or myoepithelial cell components. As AME, including the classical form, is associated with an increased risk of recurrence [67], surgical excision should aim to achieve a clear margin.

Miscellaneous B3 lesions such as myofibroblastoma, nodular fasciitis and granular cell tumour may present as mass lesions and mimic malignancy but are rarely associated with epithelial atypia and have negligible metastatic potential. While many breast units would still consider surgical excision optimal management, taking account of patient preference, this may not always be necessary when the diagnosis is confidently established on CNB with appropriate ancillary studies, and the imaging and pathology findings are concordant. In contrast, solitary fibrous tumour represents a true neoplasm with inherent biological risk and complete surgical excision is required to mitigate the risk of recurrence or metastasis [81]. Pseudoangiomatous stromal hyperplasia (PASH) is typically classified as a benign lesion (B2). However, cellular PASH may present as a cellular spindle cell proliferation on CNB, leading to a B3 designation. If a confident diagnosis of cellular PASH is established, with radiological-pathological concordance, surgical excision is generally not required.

Where multiple B3 components co-exist on CNB, e.g. AIDEP/ADH associated with FEA or LN, or FELs with LCIS, published series indicate that the risk of upgrade and consequently management is dictated by the most aggressive component (Table 2). Decisions should be included in a managed multidisciplinary pathway, ensuring triple assessment and accounting for any discordance.

Follow-up strategies in symptomatic practice

Routine lesion-specific surveillance is generally not required for patients with B3 lesions without epithelial atypia, regardless of whether the lesion is screen-detected or symptomatic, provided adequate diagnostic assessment or excision has been completed and radiological-pathological concordance achieved. In contrast, the role of imaging follow-up after the management of B3 lesions with epithelial atypia remains controversial. This reflects two distinct clinical considerations: the short-term risk of residual or unsampled atypical disease and the long-term increased risk of subsequent breast cancer associated with the underlying atypical lesion. Historically, routine surveillance has been mandated following VAB or VAE because complete removal of the lesion with epithelial atypia cannot always be guaranteed, leaving a risk of occult malignancy. Conversely, when complete surgical excision achieves clear margins and radiological–pathological concordance, the rationale for surveillance shifts from detecting localised residual disease to managing the patient's elevated background risk of future breast cancer, which may occur in either breast.

Given that the increased breast cancer risk associated with atypical lesions persists for many years, surveillance limited to a defined short-term period may not adequately address this long-term risk. Nevertheless, the optimal duration, frequency, and modality of follow-up remain uncertain, and considerable variation exists among international guidelines. In 2018, the United Kingdom (UK) National Health Service Breast Screening Programme (NHSBSP) implemented mandatory annual mammographic surveillance for 5 years following the diagnosis of certain atypical lesions to generate prospective outcome data [16]. In contrast, other international frameworks adopt a more cautious approach. The European guidelines [10] recommend surveillance without specifying its frequency or duration, while the Third International Consensus [15] did not reach a vote on follow-up recommendations. The American Society of Breast Surgeons (ASBrS) [82] advises imaging surveillance at 6, 12, and 24 months following management, whereas NCCN [66] advocates a risk-adapted strategy incorporating annual mammography (with digital breast tomosynthesis where available) and supplemental breast MRI for women with an estimated lifetime breast cancer risk of ≥20%. Patients with confirmed ADH, LN, or mixed atypia should ideally be incorporated into established high-risk management pathways that include formal risk assessment, discussion of risk-reducing strategies, including chemoprevention, and risk-adapted imaging surveillance [7, 16, 23, 83]. Consequently, follow-up practices vary considerably between institutions. Some centres return patients to routine population-based screening after complete excision, whereas others advocate enhanced mammographic surveillance, particularly for younger women or those with additional risk factors.

Therefore, further evidence is required to determine whether follow-up strategies should be guided primarily by the adequacy and completeness of lesion removal or by the underlying biological risk associated with atypical breast lesions. Recent data from the Sloane screen-detected atypia audit demonstrated that the risk of cancer at years 1 and 3 was low, comparable to the general population, confirming that the VAE pathway is safe with negligible underestimation of malignancy [23, 24]. Based on these findings, the recent NHSBSP update has abolished the requirement for routine annual mammographic follow-up for screen-detected atypia, returning these patients directly to the standard triennial screening pool [25].

Crucially, there is little to no evidence regarding follow-up strategies for atypia diagnosed in the symptomatic setting. While many units empirically manage these patients similarly to those with screen-detected lesions, symptomatic cohorts often include younger women with dense breast tissue, which reduces the negative predictive value of conventional mammography. While supplemental ultrasound or MRI is often deployed case-by-case, surveillance methodologies for patients under the population screening age are not standardised. For women approaching screening age, a planned transition into the national screening programme is prudent; however, management protocols for much younger women remain challenging. Given these gaps in evidence, standard annual imaging follow-up is currently adopted in many centres for patients diagnosed with breast epithelial atypia presenting in the symptomatic practice while further data are accumulated. To address this, the National Coordinating Committee for Breast Pathology, in collaboration with the Association of Breast Surgery (ABS), is establishing a multicentre retrospective UK audit evaluating upgrade rates and long-term outcomes in symptomatic patients under 50 years of age with atypia. Data from this initiative will be pivotal in establishing evidence-based recommendations and refining surveillance techniques and strategies for this underrepresented cohort.

Advanced imaging (MRI and CEM) in symptomatic b3 management

While MRI and CEM are superior for assessing disease extent in dense breasts, their specific role in symptomatic B3 lesions requires a nuanced approach [22, 84]. Proactive use of MRI or CEM following a symptomatic B3 diagnosis should be considered when there is significant radiological-pathological discordance or to exclude occult

multicentricity that may alter the surgical plan. However, current evidence remains limited on whether a "negative" MRI can safely preclude surgical excision; a negative scan does not necessarily rule out the risk of upgrade associated with the original B3 focus. In this context, CEM is emerging as a pragmatic, cost-effective alternative to MRI, offering potentially comparable sensitivity for identifying associated malignancy [22, 84]. The role of functional imaging in B3 lesions remains under evaluation, and all cases should be discussed within an MDT setting.

Limitations of current evidence

Evidence guiding the management of B3 lesions in symptomatic practice is limited. B3 lesions with epithelial atypia are uncommon in symptomatic practice, and data are derived predominantly from retrospective studies with small sample sizes, varied definitions, variable biopsy techniques, and selection bias. Most available data derive from screening cohorts, and many studies primarily report upgrade rates rather than providing robust evidence to inform surveillance and management strategies. An additional limitation relates to recognised interobserver variability in the histopathological diagnosis of several B3 entities. Studies have demonstrated substantial interobserver variability in the assessment of borderline lesions such as FEA, LN, particularly ALH, and FELs which may be under-recognised or underdiagnosed on CNB [38–40]. Such variability may influence reported upgrade rates and complicate comparisons across studies.

While guidance based on available evidence and expert consensus, such as presented in this review, remains valuable in this context, recommendations are necessarily subject to revision as new data emerge. Although most published data originate from the UK and European practice, these entities are universally recognised as high-risk lesions, and the underlying management principles remain broadly applicable across healthcare systems.

Future directions

Priorities for future research include multi-centre data collation of B3 lesions from symptomatic patients, the development of prospective, ideally randomised, studies in this setting, and the standardisation of pathological reporting, ideally with centralised pathological review. From a biological perspective, improved understanding of the mechanisms underlying breast cancer development may enhance the management of B3 lesions, whether symptomatic or screen-detected, by enabling more accurate assessment of malignant transformation risk and identifying opportunities for early interception strategies. Artificial intelligence algorithms in radiology may be able in the future to refine the diagnostic criteria and improve targeting of suspicious lesions [85]. The identification and validation of reliable biomarkers, together with emerging genomic risk assessment approaches such as SNP-based risk profiling used in initiatives like MyPEBS [86], may further refine personalised risk stratification and guide tailored surveillance or intervention strategies. Therefore, the development of dedicated, evidence-based guidelines for the management and follow-up of symptomatic B3 lesions remains an urgent priority. In this light, there is an increasing tendency to de-escalate surgery in view of recognised overtreatment for some of these lesions.

Conclusions

The management of B3 lesions in symptomatic practice remains challenging. Given the limited direct evidence, current management remains largely individualised, MDT-based and aligned to the screen detected lesions guidelines. Improvements in tailored, risk-adapted approaches that integrate pathological, radiological and clinical findings alongside patient preference are required. While VAE and surveillance are appropriate for many patients, surgical excision continues to be advised for selected symptomatic B3 lesions. Prospective studies and formal consensus exercises are required to establish structured recommendations and standardise evidence-based follow-up in symptomatic lesions with epithelial atypia.

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