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FULL PAPER

Phyllodes tumours of the breast: radiological presentation, management and follow-up

¹E MCCARTHY, FFRCSI, ¹J KAVANAGH, MRCP, ¹Y O'DONOGHUE, ¹E MCCORMACK, ²C D'ARCY, FRCPath and ¹S A O'KEEFFE, FRCR, FFRCSI

¹Department of Radiology, St James's Hospital and Trinity College Dublin, Dublin, Ireland

²Department of Pathology, St James's Hospital and Trinity College Dublin, Dublin, Ireland

Address correspondence to: Dr Eoghan McCarthy

E-mail: emcc1982@gmail.com

Objective: Phyllodes tumours (PTs) are rare neoplasms accounting for <1% of breast lesions. With increased breast awareness and screening programmes, smaller PTs are being detected. The purpose of this study was to determine the clinical, radiological and pathological presentation of PTs and to evaluate the role of imaging follow-up, for which there are no specific guidelines.

Methods: A retrospective study of all patients diagnosed with PT in a symptomatic unit between January 2006 and March 2013 was carried out. Patients were identified using breast care and electronic patient record databases.

Results: 53 patients with 54 lesions were diagnosed as having a PT. The median age was 27.5, 35.0 and 38.5 years for benign, borderline and malignant PT, respectively. Borderline and malignant PTs were larger than benign

PTs, with mean sizes of 33 and 42 mm compared with 29 mm. 38% of PTs were labelled by the reporting radiologist as fibroadenomas, including two borderline PTs and one malignant PT. In 24% of cases, the radiologist raised the possibility of PT in the report. 17 patients (40%) developed a new fibroepithelial breast lesion during follow-up of which 4 were recurrent PTs.

Conclusion: Despite adequate surgical management, the development of further fibroepithelial lesions in the ipsilateral breast is common. 3-year clinical surveillance, with the addition of 6-monthly ultrasound is advised for females with initial borderline or malignant PT histology.

Advances in knowledge: We propose a follow-up protocol with ultrasound based on the grade of the PT diagnosed for 3 years to detect recurrence.

Phyllodes tumours (PTs) are rare biphasic fibroepithelial neoplasms accounting for <1% of all breast lesions.¹ In the literature, they have been described as occurring in females aged 35–55 years, typically 15–20 years older than females with fibroadenomas (FAs) and with a higher incidence in Asian females.^{2,3} Imaging findings of PT and FA overlap and as such lesions may be misdiagnosed.⁴ Histologically, PTs can be identified by their distinctive leaf-like architecture and increased stromal cellularity.⁵ Typically, PTs present as a palpable breast lump and were traditionally differentiated from FAs based on their larger size at presentation.⁶ However, with increased breast awareness and screening programmes, smaller and incidental lesions are being found on imaging.⁶ In symptomatic breast clinics, including this institution, “triple assessment” consisting of an initial physical examination, followed by radiological imaging (ultrasound and/or mammography) and histological sampling either by fine-needle aspiration cytology (FNAC) or core biopsy is the standard diagnostic pathway for palpable breast lesions. The purpose of triple assessment is to provide a more accurate pre-operative diagnosis to ensure

proper surgical planning and avoiding re-excision or tumour recurrence.⁷

According to the World Health Organization criteria, there are two grading systems for PTs; a two-tiered system or a three-tiered system.⁸ Our institution employs the three-tiered system, the subgroups being benign, borderline and malignant. Grading is based on semi-quantitative assessment of stromal cellularity, cellular pleomorphism, mitotic activity, margin appearance and stromal distribution. The standard procedure for treatment, no matter what the grade of the PT, is surgical wide local excision, preferably with clear margins of at least 1 cm. However, owing to the fact that most PTs are not fully diagnosed pre-operatively, initial surgery does not always provide adequate margins necessitating frequent post-operative re-excision of the margins.³

The purpose of our study was to determine the radiological findings in females diagnosed with PT in our institution, including both initial presentation and subsequent representations. Based on the findings of the

study and review of the literature, a suitable protocol for the imaging follow-up of these females was to be proposed.

METHODS AND MATERIALS

A retrospective study of all patients who were diagnosed with a PT was undertaken, in our symptomatic breast unit, between January 2006 and March 2013. The breast care database, electronic patient record and picturing archiving and communication system medical records were examined. All patients who presented with breast lesions, which were suggestive of PT on FNAC or core biopsy of the breast, or diagnosed on post-operative histology were included in the study. Patients for whom surgical records were unavailable were excluded from the study. For each PT, the data collected included the age of the patient at presentation, the clinical examination (E) score, the imaging scores [breast imaging-reporting and data system (BIRADS) equivalent], including both the ultrasound (U) and mammography (M) scores that were assessed by one of four consultant radiologists with a sub-speciality interest in breast imaging. A biopsy (B) score was recorded if histology from core biopsy was obtained. Where a B score was not available, the cytology score (C) was recorded instead. The type of PT diagnosed (benign, borderline or malignant) was also documented.

Retrospective review of the sonographic and mammographic appearance of each PT was performed. In particular, the presence of the following characteristics at ultrasound was determined: well-defined, lobulations, heterogenous internal echogenicity, cysts, clefts, pseudocapsule, irregular outline and calcification, and at mammography: well-defined, lucent halo, somewhat obscured, irregular outline, lobulations, microcalcification, macrocalcification and high density. Review of the ultrasound report was undertaken to determine whether the lesion had been labelled as an FA or a PT.

Data were collected on whether clinical and radiological surveillance for recurrence was performed, including the imaging modality used, and whether further ipsilateral breast pathology was detected on either surveillance or patient presentation with a new palpable abnormality. If a further ipsilateral breast lesion was detected, the method of detection and the results of subsequent biopsies were recorded.

Patients presenting with a breast lump undergo clinical examination, bilateral mammography if over 35 years of age and focused ultrasound. In our institution, The Royal College of Radiologists (RCRs) Breast Group's breast imaging classification system is used, which categorizes the level of suspicion for malignancy on imaging from 1 to 5.⁹ Solid masses with benign features found in females aged 25 years and over are classified as Category 3 (U3), as such lesions require needle biopsy to establish a diagnosis and exclude malignancy. Our institution has a protocol of non-biopsy of solid masses in females aged under 25 years with typical imaging findings of an FA, based on the literature.^{10,11} All lesions not fully meeting the criteria in females aged under 25 years but likely to represent an FA are given a U3 score and are subject to sampling.

The protocol for surgical management of FA in our institution is to discharge all patients without follow-up for concordant

biopsy-proven FA <2.5 cm. Excision is recommended to patients with biopsy-proven FA >3 cm. All lesions are biopsied prior to surgical removal, since 2010, resulting in all U2 lesions over 3 cm also being biopsied. Patients with lesions measuring 2.5–3.0 cm are clinically reviewed at 6 months following biopsy. Patients who do not undergo surgical excision are given verbal and written information to return to the clinic if they notice any increase in size of the lesion. Lesions are also removed because of patient preference regardless of size.

Prior to 2010, cytology was available at the breast clinic at the time of imaging and was performed to provide same-day diagnosis for palpable masses. Lesions that were concordant (e.g. E2, U3, C2) did not always progress to core biopsy. Since 2010, all solid breast masses are subject to core biopsy with the exception of those masses in females aged under 25 years, which meet the protocol as described. Therefore, the majority of patients prior to 2010 had both cytological and histological analysis providing an opportunity to compare the sensitivity of the two modalities of sampling.

Surgical management of PT diagnosed pre-operatively was excision with a margin of 10 mm if the lesion was borderline or malignant. Re-excision of margins took place if required following multidisciplinary discussion.

Age and lesion size were compared across groups by the Kruskal–Wallis test. Statistical analysis was performed using SPSS® v. 20.0 (IBM Corporation, Armonk, NY). Owing to the retrospective nature of the study, a waiver was obtained from the institutional review board, and patient consent was not required.

RESULTS

20,401 patients presented to the symptomatic breast unit during the study period June 2007 to January 2013. 6340 patients were aged 34 years or under on presentation, while 14,061 were aged 35 years or over. 66 patients were diagnosed with PT; either on pre-operative histological sampling, when a B3/C3 histology report was suggestive of a PT, or on the post-operative specimen. Four patients with C3 cytology were downgraded to FA on core biopsy. Surgical records were not available for three patients, and five patients with a pre-operative diagnosis of PT were downgraded on post-operative histology: four to FA and one to mammary hamartoma.

In total, 54 PTs were excised in 53 patients, representing the presence of a PT in 0.3% of symptomatic females presenting to our breast unit. Over the same time period, 213 further FAs were excised and approximately 1400 FAs were diagnosed by cytology or core biopsy. The ultrasound images of 50 of 54 PTs were available for retrospective review. 21 patients had mammography, of whom imaging was available for review on 20 patients.

If a positive pre-operative radiological diagnosis is represented by a U3 score or higher and a histocytological diagnosis is represented by a C3/B3 score or higher, the sensitivity of imaging, cytological and core biopsy pre-operative diagnosis of PT was 98%, 50% and 80%, respectively. However, 19/50 (38%) PTs were labelled by the reporting radiologist as FAs including two

borderline PTs and one malignant PT. In only 12/50 (24%) cases did the radiologist raise the possibility of a PT in the report suggesting a much lower sensitivity in predicting a PT over FA in the advance of biopsy (Table 1). In the remaining 19 cases, the radiologist labelled the lesion as U3 without suggesting whether it was an FA or PT. The mean age and median age at presentation were 33 and 31 years, respectively, and the mean size of the lesions at radiology was 33 mm in maximum diameter (mean size benign PT, 29 mm; borderline PT, 42 mm; and malignant PT, 33 mm). No statistically significant differences in age or lesion size were demonstrated. The breakdown of tumour types and imaging scores is outlined in Table 2. E scores were only documented in 21 cases of which 19 lesions were E3, with solitary E4 and E5 lesions both of which turned out to be borderline PT. All of the lesions were palpable, and none was detected incidentally on imaging.

Pre-operatively, all patients with a malignant PT were given a B3/C3 or higher histology score, 15/16 (94%) patients with a borderline PT were given a B3/C3 or higher score; however, only 22/34 (65%) patients with benign PT were given a B3/C3 or higher score. In our series of 54 lesions, 1 patient had a U2 score (1 malignant PT) at presentation, 40 had a U3 score, 12 had a U4 score (5 benign PT, 6 borderline PT and 1 malignant PT) and 1 had a U5 score (borderline PT). Of the 21 patients who underwent mammography, 1 lesion was mammographically occult (benign PT), 13 had an M3 score (including 2 malignant PTs), 6 had an M4 score (2 benign PTs and 4 borderline PTs) and 1 patient had an M5 score (borderline PT). 13 patients (25%) also had FA in either breast at the time of diagnosis of the PT.

On ultrasound, 43 of 50 lesions (86%) were well defined, 29 (58%) were lobulated, 29 (58%) had a pseudocapsule, 23 (46%) had heterogenous internal echogenicity, 13 (26%) contained internal cysts, 19 (38%) were called FAs by the reporting radiologist (including 2 borderline and 1 malignant), and 12 (24%) were called probable PTs (4 benign, 8 borderline and 1 malignant). Only 2 lesions had irregular outlines, both of which were borderline PTs. On mammography, the lesion was well defined on mammography in 12 (60%), somewhat obscured in 7 (35%) and irregular in 1. 9 (45%) had visible lobulations on mammography, and 8 (40%) had a lucent halo. No lesion contained macrocalcification or microcalcification.

Clinical follow-up was carried out in all patients. A decision to carry out follow-up imaging surveillance was made at the Multidisciplinary Team Meeting with input from surgery,

oncology, radiology and histology. Surveillance was advised for all borderline and malignant lesions, but surveillance for benign phyllodes was at the discretion of the operating surgeon. Surveillance consisted of 6 monthly clinical review and 6-monthly ultrasound in all patients and annual mammography in patients aged over 35 years for a period of 36 months. Surveillance ultrasound consisted whole-breast ultrasound of the ipsilateral breast. In total, imaging follow-up was performed in 42 patients; all patients with malignant PT, 15/16 patients with borderline PT and 23/34 patients with benign PT. 17 patients (40%) were diagnosed with a new fibroepithelial breast lesion during follow up (range, 2–48 months) (Table 3). Nine of these lesions were detected during surveillance imaging, while eight were detected clinically. Eight lesions were found in the same quadrant of the breast comprising four FAs, one benign PT, two borderline PTs and one malignant PT. All of these PTs were labelled as recurrences giving a recurrence rate of 5.8%, 12.5% and 0% for benign, borderline and malignant PT, respectively. A further patient who originally had a benign PT presented clinically with a further benign PT in the contralateral breast.

DISCUSSION

Histologically, PT typically exhibits an enhanced stromal intracanalicular growth pattern with leaf-like projections into variably dilated lumina. The lumina are lined by epithelial and myoepithelial cell layers stretched into arc-like clefts lining the stromal fronds. PTs are most commonly classified as benign, borderline or malignant based on the assessment of several histological factors, including the degree of stromal cellularity, stromal cell atypia (pleomorphism), number of stromal cell mitoses, tumour margin and the presence of stromal overgrowth. Difficulty is often encountered in the classification of these lesions, as assessment of some of the latter features is subjective. Distinction of cellular FA and benign PT can be particularly problematic on core biopsy material and if there is uncertainty, a “B3” classification is given, stating “cellular fibroepithelial lesion” requiring excision for definitive classification.¹² On excision specimens, benign PTs exhibit low cellularity, circumscribed borders, less than five mitoses per ten high-power fields (HPFs), monomorphic stromal cell nuclei and lack stromal overgrowth. Malignant PTs show increased cellularity, infiltrative borders, more than ten mitoses per ten HPFs, marked stromal nuclear pleomorphism and stromal overgrowth ± stromal malignant heterologous elements (e.g. malignant bone/cartilage/fat). Borderline PT falls between benign and malignant, possessing some but not all of the characteristics of malignant PTs.¹³

Table 1. Demonstrates the sensitivity of fine-needle aspiration cytology (FNAC) and core biopsy in the diagnosis of benign, borderline and malignant phyllodes tumours (PTs)

Classification	FNAC sensitivity	Core biopsy sensitivity	Imaging sensitivity	Labelled as PT
Benign	2 of 6 (33%)	20 of 28 (71%)	34 of 34 (100%)	3 of 31 (10%)
Borderline	1 of 1 (100%)	14 of 15 (93%)	16 of 16 (100%)	8 of 15 (53%)
Malignant	1 of 1 (100%)	3 of 3 (100%)	3 of 4 (75%)	1 of 4 (25%)
Overall	4 of 8 (50%)	37 of 46 (80%)	53 of 54 (98%)	12 of 50 (24%)

The table also demonstrates the imaging sensitivity for lesions called U3 and above; however, the final column shows the percentage of PT correctly identified by the reporting radiologist indicative of a much lower true sensitivity in predicting a PT over fibroadenomas in the advance of biopsy.

Table 2. Demonstrates the breakdown of benign, borderline and malignant phyllodes tumours (PT) into number of lesions, mean and median age at presentation, mean size (mm) at radiology, pre-operative ultrasound (U) score, mammography (M) score, core biopsy (B) score and fine-needle aspiration cytology (C) score

Variable	Benign PT	Borderline PT	Malignant PT	<i>p</i> -value
Number of lesions	34	16	4	
Median age (years) (IQR)	28 (21–41)	35 (23–42)	39 (22–49)	0.62
Mean imaging size (mm)	29.1 (13.3)	41.6 (21.2)	33.0 (8.5)	0.06
U score				
U2	0	0	1	
U3	29	9	2	
U4	5	6	1	
U5	0	1	0	
M score (over 35 years)				
M1	1	0	0	
M2	0	0	0	
M3	8	3	2	
M4	2	4	0	
M5	0	1	0	
Pre-operative B/C score				
B2	8	1	0	
B3	20	13	3	
B4	0	0	0	
B5	0	1	0	
C2	4	0	0	
C3	2	1	0	
C4	0	0	1	

IQR, interquartile range.

The percentage of symptomatic females presenting for assessment, diagnosed with a PT in this study was 0.3%, correlating with existing literature.^{1,14,15} The median age of patients with a confirmed PT on excision was 31 years with a mean age of 33 years (range, 14–70 years). 34 patients were aged 34 years or younger (0.54% of patients in this age group) and 25 patients (0.18% of patients) were aged 35 years or older. Our incidence of PT among females presenting to the breast clinic was three times higher in females under the age of 35 years. Both our mean and median ages at presentation were lower than that found in the literature, where median age ranges of 40.0–51.5 years and mean age ranges of 38.6–43.0 years are reported.^{3,6,16–19} Our association of increasing age with increasing tumour grade is similar to that found in the literature, but again our mean patient age in each group was lower; 31.8 years for benign, 34.4 years for borderline and 36.5 years for malignant tumours than ranges of 39.1–39.5, 41.7–43.2 and 46.8–47.6 years, respectively, in the literature.^{3,6,16–19}

This may be owing to a combination of factors. It may be owing to a younger patient population, although the unit serves

a mixed population of approximately 600,000 people. Increased breast awareness with earlier diagnosis and improved management of symptomatic breast masses may play a role. More likely it is owing to the policy of biopsy for all solid masses resulting in increased diagnosis of benign PTs, which would have been reported as stable BIRADS 3 lesions if ultrasound follow-up alone had been performed. In one study, in Australia, 40% of PTs were not diagnosed at the first visit but diagnosed on ultrasound follow-up owing to an increase in size of the lesion.¹⁹ In our study, sampling was always performed at the first visit with the exception of the one female aged under 25 years. This would be supported by the mean size of lesions at presentation being smaller than that of the literature with a mean overall size of 33.3 mm and the mean size of benign, borderline and malignant tumours measuring 30, 42, 31 mm, respectively. This compares to a mean overall size of 40 mm with benign, borderline, malignant tumours measuring 37, 42 and 62 mm, respectively, in a recent study.¹⁸

The presentation and incidence of PT in females aged under 30 years is important as recent studies have attempted to

Table 3. Demonstrates the characteristics of the 17 patients who developed fibroepithelial lesions during follow-up

Original lesion	New lesion	Discovered	Months elapsed	Same breast	Same quadrant
Benign PT	FA	Ultrasound	12	Bilateral	Yes
Borderline PT	FA	Clinically	36	No	No
Benign PT	Benign PT, FA	Clinically	18	No	No
Borderline PT	FA	Ultrasound	6	Yes	No
Benign PT	FA	Ultrasound	36	Yes	No
Benign PT	Borderline PT	Clinically	30	Yes	Yes
Benign PT	FA	Clinically	16	No	No
Benign PT	FA	Ultrasound	12	Yes	No
Borderline PT	FA	Clinically	48	Yes	No
Benign PT	FA	Clinically	6	Yes	Yes
Benign PT	FA	Ultrasound	6	Yes	Yes
Benign PT	FA	Mammography	12	No	No
Borderline PT	Malignant PT	Ultrasound	18	Yes	Yes
Benign PT	FA	Clinically	2	No	No
Benign PT	Benign PT	Clinically	4	Yes	Yes
Benign PT	FA	Ultrasound	12	Yes	Yes
Borderline PT	Benign PT	Ultrasound	12	Yes	Yes

FA, fibroadenoma; PT, phyllodes tumour.

The original lesion, new lesion, method of discovery, time (in months) elapsed from initial surgery and the location of the new lesion are documented PTs.

propose guidelines to establish which lesions in young females can be safely managed without biopsy to avoid unnecessary invasive procedures.¹ Maxwell and Pearson¹¹ outlined the clinical and ultrasonographic criteria by which needle sampling can be avoided in young females aged under 25 years. Their criteria included age less than 25 years; no known risk factors for breast malignancy; mass not rapidly enlarging; smooth discrete mobile mass on clinical examination or impalpable lesion; well-defined homogeneously isoechoic or mildly hypoechoic solid mass; <3 cm in greatest dimension; ovoid shape, aligned parallel to the skin surface; smooth or gently lobulated contour (two or three lobulations only; no microlobulation); thin echogenic pseudo-capsule; no calcification; and no acoustic shadowing. These criteria have been widely adopted in symptomatic breast clinics.

Maxwell et al¹² described a single case over their 17-year study, where a patient had features on ultrasound and clinical examination that were typical of an FA measuring <30 mm that enlarged in size prompting biopsy and subsequent diagnosis of a PT. In our cohort, one 18-year-old patient was given a U2 score on presentation following careful assessment with ultrasound. The lesion measured 25 mm, was initially diagnosed as a typical FA and was not histologically sampled at presentation. However, the lesion increased in size to 5 cm over the course of 6 months prompting representation on clinical grounds and surgery to remove what proved to be a malignant PT. The results of this study suggest that it is not possible to accurately differentiate PT from FA pre-operatively in all patients despite the application of strict sonographic criteria and core biopsy of all

solid lesions over 25 years. Any change in size of a U2 lesion under 25 years and all B2-presumed FAs on core biopsy should prompt suspicion that the lesion is a PT. It is established that larger PTs are in general more likely to be of a higher grade, and all lesions in our institution measuring >30 mm are excised.^{20,21} However, size criteria alone are not sufficient to distinguish FA from PT, indeed the mean size of our 34 benign PTs was 29 mm and 9 lesions were <30 mm in the under-25-year age group.

FNAC sensitivity of 50% and core biopsy sensitivity of 80% lie within the quoted ranges of 25–70% and 44–92%, respectively.²¹ Internationally, particularly in the USA, the majority of patients who have a B2 concordant biopsy result undergo follow-up imaging. Although this varies by institution, practices include ultrasound every 6 months for 36 months and annual mammography.^{22–25} This practice will detect some of those PTs not diagnosed on core biopsy as a result of an increase in size on follow-up. However, the practice in the UK and Ireland is to discharge patients with concordant benign biopsy results, in particular females with U3 imaging and B2 biopsy results. In our study, 8/28 benign PTs and a borderline PT were given a B2 biopsy score pre-operatively, which highlights the importance of educating females to return to the breast unit if they detect a change in size of their breast lump regardless of the reassurance of a benign biopsy.

Most PTs like FAs on ultrasound are hypoechoic and oval, and less than half are lobulated.^{19,26,27} However, there are several imaging features that are reported to be more frequently detected

Figure 1. A proposed algorithm for the management and follow-up of fibroepithelial lesions within the breast. B, biopsy score; FU, follow-up; PT, phyllodes tumours; US, ultrasound.

in PTs than FAs. These are lobulations, heterogeneous internal texture, cystic components, horizontal linear clefts, hyperechoic septae, rich vascularization, the absence of microcalcifications and irregular margins.^{16,17,19,26–30} The sonographic appearance of a PT may be related to the grade of the lesion. In one study, most PTs (97%) were well circumscribed and surrounded by a partial or complete capsule or pseudocapsule.¹⁹ In another study, the presence of an irregular shape significantly correlated with malignant and borderline lesions and occurred in 66.7% and 90.9% of these lesions, respectively, compared with 25% of benign PTs.²⁷ In our study, an irregular shape was rare (4%) and the majority of lesions were well defined with lobulations. In particular, all of the malignant phyllodes were well defined, 2/4 had cysts and only 2/4

had lobulations. This is also in contrast to a previous study, which reported macrocysts as an uncommon finding overall, but present in four of five malignant PTs in their study.¹⁹ 13/50 of the PTs in our study had cysts, only 6 of which were borderline or malignant.

Despite the described differentiating features, in previous studies, up to 50% of PTs are incorrectly interpreted as FAs on ultrasound, including 75% of benign PTs.²⁷ In our study, 38% of the PTs were labelled as FAs in the report with a PT only being suggested in 24% of cases.

Mammographic features of PT are also non-specific mimicking cysts, FAs and well-circumscribed carcinomas. On

Figure 2. (a) Mammogram demonstrating a lobulated mass in the superior breast. (b) Subsequent focused ultrasound demonstrating a solid cystic mass, which at resection was confirmed to be a malignant phyllodes tumour.

mammography, PT appear as round, well-defined, lobulated, high-density masses, which can have a lucent halo^{16,26,27} similar to our findings. They can rarely have coarse calcifications but almost never microcalcification, neither of which was present in our study.¹⁶ Although malignant PTs usually have circumscribed borders, they can have ill-defined or spiculated margins. In our series, of the seven patients with an M4 score or higher, five of the lesions were borderline PTs and two were benign. The only lesion with an irregular outline was a borderline tumour. Associated lymph node involvement is very rare.²⁷ In one series, only 28% of PTs had lobulated margins, compared with 45% in our study, suggesting that the presence of lobulation on mammography cannot be relied upon in attempting to distinguish PTs from FAs.¹⁹

The sensitivity of imaging at diagnosing an equivocal or suspicious lesion over an FA ranges from 31% to 70% with a higher sensitivity for borderline and malignant lesions (82% and 67%, respectively).²¹ In one study, if BIRADS category $\geq 4a$ was considered to be a suspicious malignant lesion, the accuracy of mammography and ultrasound was 70% and 62.5%, respectively, with no correlation of histological grade with ultrasound findings.²⁷ The version of the RCR Breast Group scoring system used in this institution does not differentiate between a typical-appearing FA and a lesion with some minor atypical features as all are labelled U3 and therefore the true sensitivity of ultrasound at diagnosing a PT in this study cannot be given.

Following excision of a PT, there are no specific follow-up imaging guidelines in the literature. Local recurrences are known to occur in all PTs with rates of 5–17%, 14–25% and 23–47% for benign, borderline and malignant PTs, respectively.^{13,18,31} Our rates were 6%, 13% and 0%. The recurrences may reflect the original tumour or may show histological upgrade in 25–75% cases.^{32–34} Similar to the literature, our recurrences had various histological grades. Metastases are very rare (<2%) and are usually encountered with malignant PTs.¹³

13 patients (25%) were diagnosed with FA during follow-up imaging and 25% had FAs in either breast at the time of diagnosis of the PT. It is known that 10–16% of females with FA will develop multiple lesions.³⁵ It has been suggested that in a proportion of FA, a somatic mutation can result in a monoclonal proliferation with a propensity to local recurrence and progression to a PT can occur. It has also been postulated that induction of PT can occur as a result of growth factors produced by the breast epithelium such as increased oestrogen activity similar to those implicated in the development of FAs.³⁶ Our study demonstrates that females with PT are at increased risk of developing FA as well as local recurrences during follow-up. There are several reports demonstrating the association of FAs with PTs. In one series, 22.5% of patients with PT had a history of operations for PTs or FA.³⁷ In another study, 30.9% of females had concurrent FAs at the time of diagnosis of a PT, either single in 28% or multiple in 72% of these females.¹⁹ This compared with an incidence of FAs in only 7% of the females attending the same unit and 18% of those presenting with

a lump. The concurrence of FAs with PTs and the finding of FA-like areas in PTs in histology leads to speculation that PT could be a variant or sub-type of FA.³⁸

As patients on surveillance underwent ipsilateral whole breast ultrasound, it is possible that impalpable FAs in different quadrants that were present at the time of presentation of the initial PT were only detected on surveillance as that was the first time those quadrants of the breast were subject to sonographic review. Our institutional follow-up protocol, previously involved 6 monthly clinical review for 3 years with ultrasound every 6 months for females under the age of 35 years and annual mammography for females aged 35 years or over for 3–5 years, similar to one of the few protocols suggested in the literature.³⁹ 32% of our patients developed a further fibroepithelial lesion within 4 years of initial presentation, many of which were not in the index quadrant. All of the PT recurrences after a benign PT were detected clinically suggesting that imaging follow-up is not crucial for these patients. In the case of borderline and malignant PT, imaging surveillance with ultrasound of the index quadrant for 24 months would have detected all of the recurrences and reduced the detection of incidental FAs. Therefore, we propose a follow-up protocol of 6 monthly ultrasound of the index quadrant of the ipsilateral breast for all patients diagnosed with a borderline and malignant PT for 24–36 months after surgical excision and propose that mammography is not of added benefit (Figure 1).

We acknowledge that this is a small sample size and that by focusing on excised lesions we are excluding slow-growing PT that may have been misdiagnosed, clinically, radiologically and histologically as FA (Figure 2a,b).

CONCLUSION

PT is a rare breast pathology that tends to present in premenopausal females and can be difficult to distinguish from FA at imaging. With the recent change in practice to discharge young females with U2-presumed benign FA, it is crucial that both surgeons and radiologists highlight to these young females the need to return for assessment if there is a change in size of their breast lesion. Our experience of an 18 year old being diagnosed with a malignant PT mirrors previous experience in the literature and confirms that it is not possible to definitively distinguish PT from FA despite careful sonographic assessment and application of criteria to ensure benignity. The difficulty of distinguishing PT from FA extends to pathology, as only 80% of the benign PT in this series were diagnosed pre-operatively on histology. Again, this emphasizes the importance of providing written and verbal information regarding change in the size of a breast lesion to females on discharge, despite a concordant U3/B2 biopsy result.

Despite adequate surgical management, development of further fibroepithelial lesions, particularly FAs in the ipsilateral breast is common, and females should be counselled that new lumps are likely to represent benign lesions, to prevent undue stress and anxiety. Our data supports clinical follow-up of all females for 3 years following excision of PT with 6 monthly ultrasound of the index quadrant offered to those females whose initial PT was not entirely benign.

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