Original Article

The value of ultrasound to differentiate between benign and malignant duct ectasia

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Summary:

Background: Mammary duct ectasia is defined as dilated duct larger than 2 mm in diameter seen in fibrocystic changes, ductal epithelial hyperplasia, papiloma, DCIS. US has a significant role in diagnostic breast imaging. It is most commonly used as an adjunctive test in characterizing lesions detected by other imaging modalities or by clinical examination

Objective: This study was designed to investigate differences in ultrasonographic findings between malignant and benign mammary duct ectasia.

Patients and Methods: From November 2010 to July 2011, 100 womem with mammary duct ectasia lesions depicted on sonograms were included in this study. We evaluated the ultrasonographic (US) findings in terms of involved ductal location, size, margin, intraductal echogenicity, presence of an intraductal nodule, calcification, ductal wall thickening and echo changes of the surrounding breast parenchyma. The US findings were correlated with the pathological features.

Results: Of the 100 lesions, 84 lesions were benign and 16 lesions were malignant. Benign lesions include: an inflammatory change (n=14), ductal epithelial hyperplasia (n=6), fibrocystic change (n=54), intraductal papilloma (n=10). Malignant lesions include: ductal carcinoma in situ (DCIS) (n=2), infiltrating ductal carcinoma (n=14). On US images, the peripheral ductal location, an ill-defined margin, ductal wall thickening and a hypoechoic change of the surrounding parenchyma were features significantly associated with malignant duct ectasia.

Conclusion: For ill-defined peripheral duct ectasia with ductal wall thickening and surrounding hypoechogenicity as depicted on US, the possibility of malignancy should be considered and radiologists should not hesitate to recommend a prompt biopsy.

Keywords: ductectasia , ductal carcinoma in situe, ultrasound.

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Introduction:

Definition: Mammary duct ectasia is defined as dilated duct larger than 2 mm in diameter seen in fibrocystic changes,ductal epithelial hyperplasia, papiloma, DCIS.

Pathology:

This is dilatation of the major ducts, which is associated with periductal inflammation with lymphocytes and plasma cells ,so called (plasma cell mastitis). The classical description of the pathogenesis of duct ectasia is a dilatation in one or more lactiferous ducts ,which fill with a stagnant brown or green secretion. This may discharge .These fluid then set up an irritant reaction in surrounding tissue leading to periductal mastitis or even abscess and fistula formation .In those cases ,a chronic indurated mass forms beneath the areola ,which mimics a carcinoma,fibrosis eventually develops ,which may cause slit like nipple retraction.(1)

Clinical Features: Nipple discharge (of any colour) ,subareolar mass , tenderness, are the most common symptoms.(1).

Breast Ultrasonography. is recognized as the modality of choice in the evaluation of women who are symptomatic. and younger than 30 years of age, pregnant, or lactating. Combined mammography and US appear to have a role in screening high-risk populations(2). The use of standard Breast Imaging Reporting and Data System US lexicon is helpful in guiding the differentiation between benign and malignant sonographic signs. Biopsy is warranted when benign features are absent or for any feature consistent with malignancy, despite other benign findings . US is the modality of choice for guiding interventional breast procedures. The role of US as a guidance tool for nonoperative breast treatment is being investigated(3).Recently, US has been widely used for screening in women with a dense breast parenchyma.(4)The analysis of US features of solid masses continues to improve, though observer variability remains to be problematic to avoid a biopsy. The American College of Radiology illustrated Breast Imaging Reporting and Data System (BI-RADS) US lexicon is helpful to improve observer performance. (5)

**Baghdad teaching hospital /The national center for early detection of cancer.*

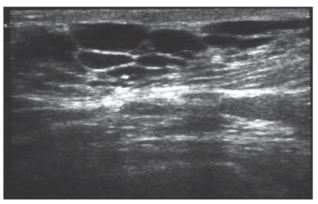
BI-RADS:
0= Need additional imaging evaluation,or prior mammogrs for comparison
1= Negative: there is nothing to comment on
2= Benign finding
3=Probably benign (<2%malignant). Initial short-interval follow- up suggested
4= Suspicious abnormality (2-95%malignant).Biopsy should be considered.
5= Highly suggestive of malignancy (>95%malignan). Appropriate action should be taken.
6=Known biopsy-proven malignancy
BI-RADS defines ductal changes as an abnormal caliber and/or arborization and describes as a change of the surrounding tissue associated with a solid breast mass.(2) However, ductal changes, especially duct ectasia itself, is a frequently encountered finding during US examination. (5).

Patients and methods:

From November 2010 to July 2011, women were submitted to the Breast center in The National Center for Early Detection of Cancer at Baghdad Teaching Hospital . This study was conducted for 100 sonographically detected mammary duct ectasia. All were female and the mean patient age was 46 yr (age range, 25-65 yr). All 100 lesions were confirmed by sonography-guided FNA using a needle of 10 ml ,gauge (22), then the US findings were correlated with the pathological features to elucidate the accuracy of US findings in differentiating malignant from benign duct ectasia . Data collection regarding age, clinical presentation, ductal location , diameter , calcification , mural , intraluminal changes , Doppler findings , nipple discharge and architectural changes . Sonography was carried out using available Siemens high-resolution real-time ultrasound machine utilizing 7.5-11MHz linear array probe. In our practices, entire breasts are scanned as a diagnostic workup for women with dense breasts by one experienced breast radiologist and once an abnormal finding is detected, US is performed in the radial and anti radial planes . The US findings of duct ectasia were evaluated in terms of lesion location, size, margin, intraductal echogenicity, presence of an intraductal nodule and calcification, ductal wall thickening and change of the surrounding parenchymal echo.

1. The location of duct ectasia was divided into central (defined as less than 2 cm from the nipple) (fig.1) and peripheral locations (more than 2 cm from the nipple) (fig.2)
2. The diameter of the duct <2mm (benign) and .>2mm (malignant)
3. The margin of a lesion was described as well defined (fig.4) or ill defined.
4. The intraductal echo pattern was described as homogeneous or heterogeneous.
5. The presence of an intraductal nodule, intraductal calcification and ductal wall thickening.
6. The echo change of the surrounding parenchyma.

After that, based on our results, we gave one point to each suspicious sonographic findings and investigated the difference of malignancy rate according to the score.



Fig(1): Central location of ductectasia

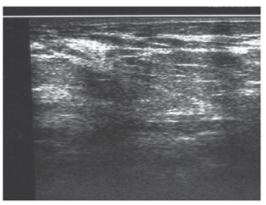


Fig (2): Peripheral location of ductectasia

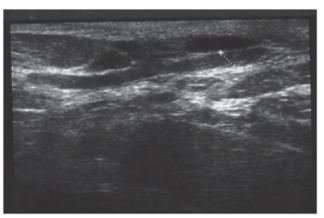
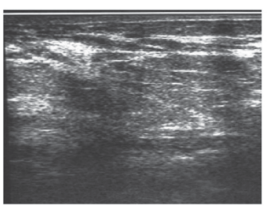


Fig (3): Duct diameter >2mm



Fig(4):well defined margin of ductectasia

Other Available Investigations

1. Mammography: the mammograms were obtained using molybdenum-target tube with 0.5mm aluminum filtration. Non screen double coated films were used. Exposure factors
were 200- 400 mass and 25-30 kV cranio-caudal and medio-lateral projections were obtained routinely. The sensitivity of this test increases with age as the breast becomes less dense.
2. FNA: aspiration cytology was obtained for patients with a localized breast lump following ultrasound examination, a needle of 10 ml syringe (22G) the aspirate was placed in alcohol solution for 20 minutes for fixation then send to cytological lab where it is processed by papinicular stain.
3.Doppler US: for detection of vascularity mass lesion .

Results:

Of 100 female patients who had visit breast center for symptomatic duct ectasia ,16/100 were malignant and 84/100 were benign .The clinical findings among those patients with malignancies, five patients had nipple

discharge , nine patients had breast mass and two patients had breast pain. Nipple discharge was found for 25/100 cases including 20 benign lesions and 5 malignant lesions. Breast mass was seen for 35/100 cases that consist of 26 benign lesions and 9 malignant lesions. Breast pain was seen for 40/100 cases including 38/100 benign and 2 malignant cases Fig (5).

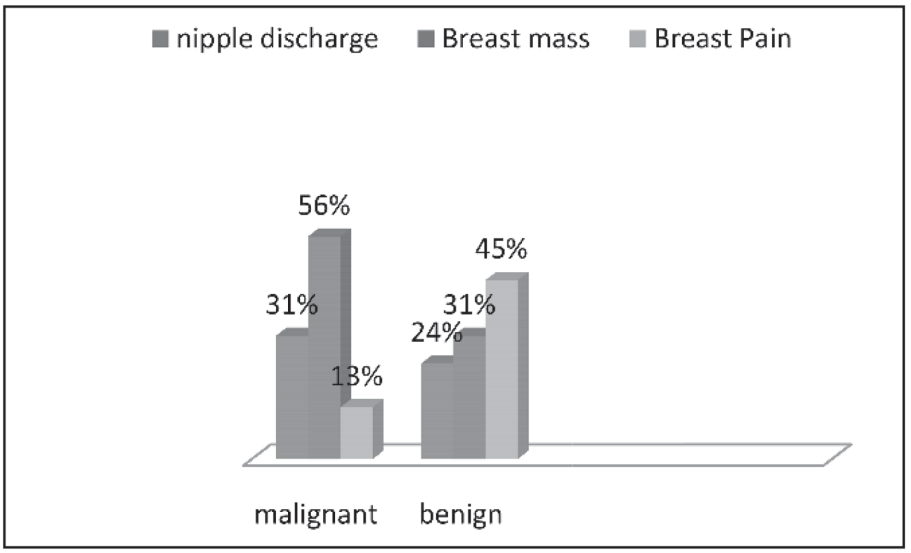


Figure no.(5)Clinical Findings in Duct Ectasia

OF the 100 lesions , 84 lesions were benign and 16 lesions were malignant based on cytology .

Table (1): Pathologic diagnosis of mammary duct ectasia

Pathology	Frequency
Benign (n=84)	
Duct ectasia with inflammatory changes	14(17%)
Fibrocystic changes	54(64%)
Ductal epithelial hyperplasia	6(7%)
Papilloma	10(12%)
Malignant (n=16)	
DCIS	2(12.5%)
Infiltrating ductal carcinoma	14(87%)

Ultrasound findings of mammary duct ectasia are shown in Table (2). Of 84 benign lesions , (72/84)of the lesions developed from central ducts .In contrast , (14/16) of malignant lesions involved the peripheral ducts ($p<0.05$) .Duct wall diameter was more than two millimeter in (76/84) of benign lesions while (16/16) of malignant lesions were more than two millimeter .In terms of margin, (15/16) of malignant lesions demonstrated an irregular margin, while (70/84) of benign lesions had regular margin ($p<0.05$). Ductal wall thickening was found in (13/16) of malignant lesions , and for (74/84) of benign lesions ($p<0.05$). Calcification was seen in (67/84) of benign lesions and (9/16) of malignant lesions ($p>0.05$).Resistive index was >0.6 in 16/16 for malignant lesions while it was <0.6 in 84/84 for benign lesions

Table (2): Comparison of US findings in duct ectasia between malignant and benign lesions

US findings	Malignant (n=16)	Benign (n=84)	p-value
Location			**<0.001**
Central	2	72	
Peripheral	14	12	
Diameter			**>0.05**
>٢mm	15	76	
Margin			**<0.001**
Regular	1	70	
Irregular	15	14	
Calcification			**>0.05**
Present	7	17	
Absent	9	67	
Duct wall thickening			**<0.002**
Present	13	10	
Absent	3	74	
Intraductal nodule			**<0.04**
Present	2	48	
Absent	14	36	
Surrounding ypoechogenicity			**<0.001**
Present	6	3	
Absent	10	81	
Intraductal Echo			**>0.05**
Homogeneous	2	34	
Heterogeneous	14	50	

Mammographic findings of mammary duct ectasia which are shown in table 5 ,of 84 benign lesions 41/84 shows retroareolar density while in malignant lesions only 3/16, micro calcifications seen in 2/16 in malignant lesions while 1/84 in benign lesions , macroscopic calcification seen in 2/16 for malignant lesions in contrast to 2/84 in benign lesions. Speculated mass was seen in 13/16 in malignant lesions while it was not seen in benign lesions. Breast density in malignant lesions was symmetrical in 1/16 and a symmetrical in 15/16 for malignant lesions while in benign lesions it was symmetrical in16/84 and a symmetrical in 68/84 .Tubular shadow seen in 2/16 for malignant lesions in contrast to 16/84 for benign lesions.

Table (3): Mammographic findings in malignant and benign mammary duct ectasia

Mammographic findings	Malignant	Benign	p. value
Calcification			>0.05
Microscopic	2	1	
Macroscopic	2	2	
Density of Breast			>0.05
Symmetrical	1	16	
Asymmetrical	15	68	
Speculated mass			<0.05
Present	13	0	
Absent	3	84	
Retroareolar density			>0.05
Present	3	41	
Absent	13	43	
Tubular shadow			>0.05
Present	2	16	
Absent	14	68	

Table (4) presents the difference of malignancy rate by score. According to our findings , suspicious sonographic findings were peripheral location , irregular margin , presence of duct wall thickening and surrounding hypoechoic parenchymal changes .Malignancy rate of score 0 and 1 was 0%, of score 2 was 20%, of score 3 was 80% and of score

Table (4): Malignant rate by score

Score	Malignant (n=16)	Benign (n=84)	Malignant rate	p-value
0	0	50	0%	<0.05
1	0	15	0%	
2	4	18	18%	
3	6	1	85%	
4	6	0	100%	

Discussion:

In our study most of patients involved are symptomatic duct ectasia, because we don't have screening programs for detection of asymptomatic duct ectasia in Iraq .Our study shows that patients with malignant duct ectasia presents with nipple discharge in 5(31%) ,breast mass in 9(56%) and breast pain in 2(12.5%) of patients.Benign duct ectasia presents clinically with nipple discharge 20(24%) ,breast mass in 26(31%) and breast pain in 38(45%) while Keum et al(3) stated that Although there was no statistical significance (p>0.05), malignant duct ectasia was more frequently symptomatic. Among the patients with malignancies, 63% of patients showed symptoms. Two patients had nipple discharge, three patients had a palpable mass and three patients underwent screening. In contrast, 41% of the patients with benign lesions were symptomaticReported diagnosis of pathological nipple discharge include intraductal papilloma(33-48%),papillomatosis (14-28%),mammary duct ectasia(2-10%). In our study ,16(16%) of mammary duct ectasia lesions were was malignant 2(12.5%) of which were DCIS and infiltrating ductal carcinoma in 14(87%) of patients. Pathological diagnosis of benign duct ectasia was found in 84(84%) of patients represented as duct ectasia with inflammatory changes in 14(17%),fibrocystic changes in 54(64%), ductal epithelial hyperplasia in 6(7%),and papilloma in 10(12%).

Keum(3) reported in his study 15% of mammary duct ectasia were malignant , Cho et al (6) reported 17% of non-calcified lesions detected on US were manifested as pure ductal changes without a solid mass. The recent use of high resolution US can help to detect subtle findings of non-calcified DCIS, especially lesions that manifest as pure ductal changes. When nipple discharge is vague or originates from multiple openings, US is possible to visualize mammary duct ectasia distinctively regardless of nipple discharge and to evaluate the location , size and intraductal features such as the presence of a nodule or calcification and the echo-pattern. US is also able to evaluate a surrounding parenchymal echo change. Radial US is particularly useful to depict the intraductal pathology and to evaluate the extent of ductal disease.Mammary duct ectasia is defined as a dilated duct larger than 2 mm in diameter. Duct ectasia affects the major ducts in the subareolar region, but sometimes the smaller segmental ducts can be involved .Thick unresorbed secretions and cellular debris may fill the distended ducts. Periductal fibrosis is found in association with an inflammatory infiltrates.(7)Based on our findings , in contrast to benign lesions , most malignant duct ectasia lesions involved the peripheral ducts 14(87.5%) while in benign duct ectasia involve central ducts in 72(85.7%),(p<0.001),this result agreed with the finding of Keum who reported that Of the 46 benign lesions, 74%

(34/46) of the lesions developed from the central ducts . In contrast, 88% (7/8) of the malignant lesions involved the peripheral ducts ($p<0.05$) .Duct dilatation may be secondary to periductal inflammation where the ducts become patulous and the filled with unresorbed material and cellular debris(7).Several histopathological conditions affect the intraductal echotexture. Calcified DCIS lesions usually show a mild hypoechoic , heterogeneous echotexture ,probably due to the punctuate echogenic calcifications(8). Similar US findings may also be seen for some benign lesions such as atypical ductal hyperplasia and a radial scar(6), Our study demonstrated heterogeneous intraductal hypoechogenicity in 68% (11/16) of malignant lesions and 47%(40/84) of benign lesions this result agreed with Keum et al who reported 88% and 63% of malignant and benign lesions respectively. Intra ductal echogenicity was due to intraductal secretions, inflammatory cellular debris and intraductal calcification based on histopathological findings. However, in our study, the heterogeneity of intraductal echogenicity did not provide useful information to differentiate malignant from benign duct ectasia.From our results, the most sticking feature of malignant duct ectasia was an irregular margin with ductal wall thickening .An irregular margin was found for 15/16 for malignant lesions and 14/70 of benign lesions this coincides with the findings of Keum who reported 88% and 15% for malignant and benign lesions respectively. Several studies have examined the clinical significance of microcalcifications detected on US, (8-10) Soo et al (11) mentioned that suspicious microcalcifications were seen infrequently on sonography 23%, but when detected could be successfully biopsy with sonographic guidance and more frequently were malignant lesions and represented invasive cancer as compared to lesions seen on mammography alone. Similarly , in our study , 83% of benign lesions showed no intraductal calcifications but 25% of the malignant lesions contained intraductal calcification, even though this difference was not significant statistically. For cases that show suspicious sonographic features of duct ectasia, the presence of intraductal calcification can be a helpful finding that can increase the confidence of a radiologist for a diagnosis of a malignancy.Ductal wall thickening was seen only in 10/84 of benign lesions but in 13/16 of malignant lesions, histological examinations revealed accumulation of tumor cells within ducts without evidence of invasion through the basement membrane for malignant lesions. This agreed with the result of Keum et al who reported that ductal wall thickening was seen in 13% of benign lesions and 75% of malignant lesions.In our study , malignant duct ectasia was not associated with a discrete intraductal nodule except for 11% (3/16) this agreed with Keum et al who reported only one case of eight malignant lesions. An intraductal nodule was commonly associated with benign duct ectasia , with intraductal papilloma as the most common finding.Pure clusters of microcysts without discrete solid components can be considered as benign and should be subjected to follow up .Such lesions are often due to apocrine metaplasia , though a fibrocystic change without apocrine metaplasia can have a similar appearance(10). Berg (12) reported 66 lesions prospectively characterized as clustered microcysts with no malignancies . Keum et al found only one case documented as a mucinous carcinoma with infiltrating ductal carcinoma component based on the histopathology. Our study showed 18 case depicted as aggregated cysts with ill-defined duct ectasia and a surrounding hypoechoic change. These conditions considered as benign lesions and proved later on by FNA cytology examination.From our results , 75%(12/16) of malignant duct ectasia lesions and only 7%(6/84) of benign lesions demonstrated a hypoechoic change of the surrounding breast tissue. Keum et al reported that 38% and 4% of malignant and benign lesions demonstrated a hypoechoic change in the surrounding breast tissue. The sensitivity of US in differentiating malignant from benign duct ectasia was 100% , specifity was 95% and accuracy 97.5% .The 5% lack in specifity because those patients were diagnosed as DCIS by US as they had the same sonographic features (ill defined border of duct dilatation surrounded by hypoechogenicity),but they were confirmed as ductal epithelial hyperplasia by FNA.On mammography, duct ectasia appears as a tubular , serpinginous structure converging on the nipple at the subareolar region in the fatty breast(13).Our study shows that mammography is not valuable in diagnosis of duct ectasia since all mammographic features were insignificant in diagnosis and differentiating malignant from benign duct ectasia ($p.>0.05$), this agreed with findings of Keum et al who stated the same findings .The reasons for this inaccuracy are dense or nodular parenchyma, under exposure on mammography , patient motion , poor film-screen contact.Our study presents the difference of malignancy rate by score. Based on our results, suspicious sonographic findings were peripheral location, ill defined margin, presence of ductal wall thickening and surrounding hypoechoic parenchymal changes. From this results, the malignancy rate of score 0 and 1 was 0%, of score 2 was 18%, and of score 3 was 85% and 4 was 100% ($p<0.05$). This agreed with the findings of Keum who reported the malignancy rate of score 0 and 1 was 0%, of score 2 was 25%, and of score 3 and 4 was 100% ($p<0.05$).

Author contributions:

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Jinan A. Jabbar (Drafting and Corresponding)
Laith Ahmad (Final version approval)

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