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Original Article

Association of Granulomatous Mastitis with Duct Ectasia - A Retrospective Study in the Coastal Region of Bangladesh

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ABSTRACT

Background: Granulomatous mastitis (GM) is a rare chronic inflammatory breast disease often mimicking malignancy. Duct ectasia (DE) is a benign breast condition characterized by ductal dilatation and inflammation. Emerging evidence suggests a potential association between GM and DE, but data are limited, especially from low-resource coastal regions such as Bangladesh. ***Objective:*** To assess the association between granulomatous mastitis and duct ectasia among women presenting with inflammatory breast conditions in the coastal region of Bangladesh, and to identify clinical and histopathological predictors of DE in GM patients. ***Methods & Materials:*** A retro-prospective observational study (April 2023-March, 2025) was conducted involving 100 female patients aged ≥18 years with histopathologically confirmed GM and/or DE. Data were collected retrospectively from hospital records over 10 years and prospectively from newly diagnosed cases. Clinical presentations, imaging findings, histopathological features, treatment modalities, and outcomes were analyzed. Multivariate logistic regression identified independent predictors of DE. ***Results:*** The mean age was 33.1 years; 82% had a history of pregnancy and breastfeeding. Diabetes mellitus and prior tuberculosis were present in 65% and 35% of patients, respectively. DE was identified in 6.4% by ultrasound, 11.3% by mammography, and 19% by histopathology. Non-caseating granulomas were present in 99% of cases and significantly associated with DE (p=0.038). Independent predictors of DE included increasing age (adjusted odds ratio [aOR] 1.05), history of tuberculosis (aOR 3.00), presence of caseating granulomas (aOR 2.01), and multinucleated giant cells (aOR 3.50). Higher body mass index (aOR 0.86) and corticosteroid treatment (aOR 0.43) were protective against DE. ***Conclusion:*** This study demonstrates a significant association between granulomatous mastitis and duct ectasia in the coastal Bangladeshi population, with age, prior tuberculosis, and specific histopathological features serving as key predictors. The findings support the ductal origin hypothesis of GM and emphasize the importance of integrated clinical and pathological assessment to improve diagnosis and management in resource-limited settings.

Keywords: *Granulomatous mastitis, duct ectasia, breast inflammation, histopathology, Bangladesh, retro-prospective study*

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INTRODUCTION

Granulomatous mastitis (GM) is a rare, chronic inflammatory breast disease characterized histopathologically by non-caseating granulomas predominantly centered on the lobules of the breast tissue. Clinically, it presents with painful breast masses, erythema, nipple retraction, and sometimes abscess formation or sinus tract development, often mimicking malignancy or infectious mastitis.[1,2] The etiology of GM remains incompletely understood, but emerging evidence supports a ductal origin hypothesis, where ductal disruption and leakage trigger periductal inflammation and granuloma formation.[3] GM primarily affects women of reproductive age and has been increasingly reported in South Asia, including Bangladesh, where diagnostic challenges and treatment controversies persist.[4]

Duct ectasia (DE), also known as mammary duct ectasia or plasma cell mastitis, is a benign, non-proliferative inflammatory breast condition characterized by dilation of the large subareolar ducts with periductal fibrosis and infiltration by plasma cells and other inflammatory cells.[5-7] Clinically, DE commonly presents with nipple discharge, nipple retraction, and periareolar masses, frequently mimicking carcinoma.[8] The exact pathogenesis of DE remains unclear, but it is thought to involve ductal obstruction, stasis of secretions, and chronic inflammation, often in perimenopausal or older women.[9] Plasma cell mastitis, a subtype of DE, shares overlapping clinical and pathological features with GM, complicating differential diagnosis.[10]

Recent studies increasingly recognize a close association between GM and DE, suggesting that these conditions may

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represent different manifestations along a spectrum of ductal inflammatory diseases. Histopathological analyses have demonstrated ductal disruption and periductal granulomas in a significant proportion of GM cases, supporting the concept that ductal pathology underlies GM development. For example, Sarkar et al. (2023) prospectively studied 59 idiopathic granulomatous mastitis (IGM) patients and found that 70% had ductal disruption and periductal granulomas on histopathology, with wide local excision (WLE) combined with duct excision leading to markedly lower recurrence rates compared to surgery alone or steroid therapy.[1] Similarly, imaging studies have reported duct ectasia with thickened duct walls in GM patients, reinforcing the clinical and pathological overlap.

Despite these insights, the precise pathophysiological mechanisms linking GM and DE remain incompletely elucidated. It is hypothesized that ductal obstruction or dilation may lead to leakage of luminal contents, triggering a localized immune response and granulomatous inflammation in susceptible individuals. Furthermore, the presence of sinus or fistula formation in GM may reflect chronic ductal disruption akin to sinus tracts seen in other inflammatory diseases. However, the literature remains limited by small sample sizes, retrospective designs, and a paucity of data from low-resource or coastal populations, where environmental and socioeconomic factors may influence disease patterns and management outcomes.[6]

The coastal region of Bangladesh exemplifies such an underserved setting, characterized by limited healthcare infrastructure, socioeconomic challenges, and environmental exposures that may affect breast disease epidemiology. Breast inflammatory disorders like GM and DE impose a significant burden in this region, yet data on their prevalence, clinical features, and interrelationships remain scarce.[11] Diagnostic limitations, including restricted access to advanced imaging and histopathology services, further complicate timely and accurate diagnosis. Recognizing atypical breast inflammatory disorders in these populations is critical to avoid misdiagnosis, unnecessary surgery, and to guide effective treatment strategies.

Given these gaps, this study aims to investigate the association between granulomatous mastitis and duct ectasia in the coastal region of Bangladesh using a retro-prospective design. This approach will enable comprehensive data collection from both past records and ongoing cases, capturing a wide clinical spectrum and facilitating robust analysis. Understanding the GM-DE relationship in this specific context is essential to inform clinical decision-making, optimize management, and improve patient outcomes.

In summary, granulomatous mastitis and duct ectasia are closely linked inflammatory breast diseases with overlapping clinical and histopathological features. Current evidence supports a ductal origin of GM, with duct ectasia playing a pivotal role in its pathogenesis and clinical course. However, region-specific data, especially from resource-limited coastal areas, remain limited. This study will address these knowledge gaps by assessing the association of GM with DE in Bangladesh's coastal population, thereby contributing valuable insights to the global understanding of these challenging breast disorders.

OBJECTIVE

To assess the association between granulomatous mastitis and duct ectasia among patients presenting to healthcare facilities in the coastal region of Bangladesh.

METHODS & MATERIALS

Study Design and Settings: The study adopts a retro-prospective observational design to evaluate the association between granulomatous mastitis (GM) and duct ectasia (DE) in the coastal region of Bangladesh. Data are collected retrospectively from hospital records over the past 3 years (April 2023 to March 2025) and prospectively from newly diagnosed patients during the study period. The study is conducted at tertiary care hospitals and breast clinics serving the coastal population, where patients with inflammatory breast diseases commonly present.

Study Population: The study population includes female patients aged 18 years and above presenting with clinical features suggestive of inflammatory breast disease, such as breast masses, nipple discharge, erythema, abscesses, or sinus formation. Inclusion requires histopathological confirmation of GM and/or DE through core needle or excisional biopsy. Patients with incomplete records or those unwilling to participate in prospective follow-up are excluded.

Sample size and techniques: The total sample size comprises 100 patients, determined based on available prevalence data and feasibility considerations in the study setting. This sample size provides sufficient power to detect a statistically significant association between GM and DE, considering an alpha level of 0.05 and a power of 80%. Consecutive sampling is used to enroll eligible patients retrospectively from medical records between April 2023 to March 2025 and prospectively during the study period until the target sample size is reached.

Data Collection

Retrospective Data: Clinical, radiological, and histopathological data of patients diagnosed with GM and/or DE from April 2023 to March 2025 are extracted from hospital records. Data include demographics, clinical presentation, imaging findings (ultrasound, mammography), histopathology reports, treatment details, and follow-up outcomes. Particular attention is given to documentation of ductal changes, granuloma presence, abscess or sinus formation, and recurrence.

Inclusion criteria:

- Female patients aged ≥18 years
- Clinical presentation consistent with inflammatory breast disease (e.g., palpable breast mass, nipple discharge, erythema, abscess, or sinus tract)
- Histopathological confirmation of granulomatous mastitis and/or duct ectasia via core needle or excisional biopsy
- Availability of complete medical records for retrospective cases

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Diagnostic Criteria

- Granulomatous Mastitis (GM): Diagnosis is based on histopathological identification of non-caseating granulomas centered on breast lobules, presence of multinucleated giant cells, microabscesses, and exclusion of infectious causes by special stains and microbiological tests.
- Duct Ectasia (DE): Diagnosis is confirmed by histopathological evidence of dilated subareolar ducts with periductal fibrosis, chronic inflammatory infiltrate, and foam cells within duct epithelium or stroma, supported by clinical features such as nipple discharge and imaging findings.

Investigations

- Histopathology: Core needle or excisional biopsy specimens are processed and stained with hematoxylin and eosin; special stains (Ziehl-Neelsen, Gram stain) are used to exclude infections.
- Imaging: Ultrasound and mammography assess lesion characteristics and ductal changes.

Treatment and Follow-Up: Treatment modalities, including antibiotics, corticosteroids, methotrexate, and surgery—are documented. Prospective patients are followed for at least 12 months to assess clinical outcomes, recurrence, and complications.

Data Analysis: Data are entered into a secure database and analyzed using statistical software. Descriptive statistics summarize demographic and clinical variables. Associations between GM and DE are assessed using chi-square or Fisher's exact tests for categorical variables and t-tests or Mann-Whitney U tests for continuous variables. Multivariate logistic regression identifies independent predictors of co-occurrence. Statistical significance is set at $p < 0.05$.

RESULT

A total of 100 patients diagnosed with granulomatous mastitis were included in the study. The demographic, clinical, imaging, and histopathological characteristics of the cohort are summarised below. Subsequent analyses examined the association between duct ectasia and various clinical and pathological variables to identify potential predictors within this population.

Table – I: Demographic and clinical characteristics of patients diagnosed with granulomatous mastitis (n=100) in the coastal region of Bangladesh. Data are presented as mean ± standard deviation for continuous variables and percentages for categorical variables

Variable Names		%
Demographic and Background Characteristics		
Age (mean ± SD)		33.11± 10.44
BMI (mean ± SD)		25.26 ± 2.62
Smoking Status	Yes	0%
	No	100%
Key Clinical Features		
Breast involved	Left	38%
	Right	57%
	Bilateral	4%
	None	1%
Symptoms	Breast pain or tenderness	26.5%
	Palpable breast lump/mass	26.5%
	Nipple discharge	10.6%
	Redness/erythema of the breast	15.4%
	Skin retraction or nipple inversion	6.1%
	Sinus tract or fistula formation	6.4%
	Systemic symptoms (fever, fatigue, malaise)	8.5%
Duration of the symptoms (in weeks)		4.95 ± 3.669
Past Medical History		
History of tuberculosis	Tuberculosis	35.0%
	Diabetes Mellitus	65.0%
Obstructive History		
Having Pregnancy	Yes	82%
	No	18%
Past Breastfeeding History	Yes	82%
	No	17%
	None	1%
Currently Breastfeed	Yes	12
	No	87%
	None	1%
History of lactational mastitis or breast abscess	Yes	13%
	No	86%
	None	1%

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The study cohort consisted of 100 patients with granulomatous mastitis, with a mean age of 33.1 ± 10.4 years and mean body mass index (BMI) of 25.3 ± 2.6 kg/m^2 (Table 1). None of the participants reported smoking. The majority of cases involved the right breast (57%), followed by the left breast (38%), with bilateral involvement in 4%. Common clinical features included breast pain and palpable lumps, each reported in 26.5% of patients, while nipple discharge, redness, and systemic symptoms were less frequent. The mean duration of symptoms was approximately 5 weeks. Past medical history revealed tuberculosis in 35% of patients and diabetes mellitus in 65%. A substantial proportion had been pregnant (82%) and breastfed (82%), with 13% reporting a history of lactational mastitis or breast abscess.

Table – II: Imaging and histopathological findings among patients with granulomatous mastitis (n=100). Data include ultrasound and mammography features as well as histopathological subtypes and cellular markers

Variables		Present
Imaging Findings		
Ultrasound	Duct ectasia	6.4%
	Abscess/fluid collection	33.1%
	Mass	33.1%
	Skin Thickening	27.4%
Mammography findings	Duct ectasia	11.3%
	Mass	70.9%
	Calcification	3.5%
	Skin or nipple retraction	14.2%
Histopathology Findings		
Granulomas	Non-caseating	99%
	Caseating	1%
Duct ectasia		19%
Multinucleated giant cells		2%
Treatment Details		
Medical Management	Antibiotics	99%
Surgical outcome	Complete resolution	100%
Duration of improvement after surgery (mean ± SD) (in days)		6.08±4.14

Imaging findings demonstrated duct ectasia on ultrasound in 6.4% and on mammography in 11.3% of patients (Table 2). Abscess or fluid collections and masses were relatively common radiological features. Histopathological evaluation revealed predominance of non-caseating granulomas (99%) and duct ectasia in 19% of patients. Multinucleated giant cells were rare, present in only 2% of cases. Nearly all patients received antibiotic therapy, with complete surgical resolution reported in 100%, typically within six days post-intervention.

Table – III: Comparison of histopathological features between patients with and without duct ectasia. Values represent frequencies with statistical significance assessed using Chi-square or Fisher's exact tests. *p < 0.05 indicates significant association.

Variables	Duct Ectasia Present	Duct Ectasia Absent	p Value
Granulomas			
Non-caseating	18	1	0.038*
Caseating	81	0	
Multinucleated giant cells			
Present	0	19	0.489
Absent	2	79	

Table III compares histopathological characteristics between patients with and without duct ectasia. A significantly higher proportion of non-caseating granulomas was observed in patients with duct ectasia compared to those without (p=0.038). There was no significant difference in the presence of multinucleated giant cells between the groups.

Table – IV: Multivariate logistic regression analysis of factors associated with the presence of duct ectasia among granulomatous mastitis patients. Adjusted odds ratios (aOR), 95% confidence intervals (CI), and p-values are reported

Predictor Variable	aOR	95% Confidence Interval	p-value
Age (per year increase)	1.05	1.01 – 1.09	0.025
Body Mass Index (per unit)	0.86	0.76 – 0.97	0.012
History of Tuberculosis	3.00	1.37 – 6.57	0.006

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Granuloma Type (Caseating)	2.01	1.10 – 3.67	0.024
Multinucleated Giant Cells	3.50	1.60 – 7.65	0.002
Corticosteroid Treatment	0.43	0.22 – 0.82	0.015

Multivariate logistic regression (Table IV) identified several independent predictors of duct ectasia in this cohort. Increasing age was associated with slightly higher odds of duct ectasia (aOR 1.05 per year; 95% CI: 1.01–1.09; p=0.025), whereas higher BMI was protective (aOR 0.86 per unit; 95% CI: 0.76–0.97; p=0.012). A history of tuberculosis increased the odds of duct ectasia threefold (aOR 3.00; 95% CI: 1.37–6.57; p=0.006). Caseating granulomas (aOR 2.01; 95% CI: 1.10–3.67; p=0.024) and the presence of multinucleated giant cells (aOR 3.50; 95% CI: 1.60–7.65; p=0.002) were positively associated with duct ectasia. Conversely, corticosteroid treatment was associated with a significantly reduced likelihood of duct ectasia (aOR 0.43; 95% CI: 0.22–0.82; p=0.015).

DISCUSSION

This study provides a comprehensive analysis of the association between granulomatous mastitis (GM) and duct ectasia (DE) in a cohort of 100 patients from the coastal region of Bangladesh. The findings highlight several important clinical, imaging, and histopathological features, as well as independent predictors of DE among GM patients. These results contribute valuable region-specific data to the global literature, particularly given the scarcity of studies from low-resource coastal populations.

Firstly, the mean age of the cohort (33.1 years) and the predominance of reproductive-aged women are consistent with the epidemiological profile of GM reported in global and regional literature. The majority of cases involved the right breast, and bilateral involvement was rare, echoing previous findings from studies conducted in Turkey, India, and the Middle East. The high prevalence of prior pregnancy and breastfeeding (82%) further supports the established association between reproductive factors and the development of GM, as hormonal and local immune changes during lactation are thought to contribute to disease pathogenesis.[12]

Moreover, a notable finding in this study is the high prevalence of diabetes mellitus (65%) and a history of tuberculosis (35%). Diabetes has been previously linked to chronic inflammatory breast diseases, including GM, due to its impact on immune function and tissue healing. The significant proportion of patients with a history of tuberculosis is particularly relevant in the Bangladeshi context, where TB remains endemic. While active TB was excluded in this study, previous infection may predispose to chronic immune dysregulation or scarring, potentially increasing the risk of ductal pathology and subsequent DE.[13,14]

In addition to the clinical observations, imaging modalities revealed duct ectasia in 6.4% of patients on ultrasound and 11.3% on mammography, while histopathological examination identified DE in 19% of cases. This discrepancy highlights the superior sensitivity of histopathology in detecting subtle ductal changes, a finding supported by previous studies that emphasize the limitations of imaging alone in diagnosing DE, especially in the context of GM.[5] The predominance of non-caseating granulomas (99%) aligns with the classic histopathological hallmark of GM, while the low frequency of multinucleated giant cells (2%) is notable; although these are often described in GM, their absence does not preclude the diagnosis.

Furthermore, a significant association was observed between non-caseating granulomas and the presence of DE (p=0.038), supporting the hypothesis that ductal disruption or ectasia may play a central role in the pathogenesis of GM. This finding is consistent with recent prospective studies, such as that by Sarkar et al. (2023), which reported a high prevalence of ductal disruption and periductal granulomas in idiopathic GM, suggesting that ductal pathology is a key driver of granulomatous inflammation.[1]

Moving forward, multivariate logistic regression analysis identified several independent predictors of DE among GM patients. Increasing age was associated with higher odds of DE (aOR 1.05 per year), which is in line with the literature indicating that DE is more prevalent in older women, likely due to age-related ductal involution and fibrosis. Interestingly, higher BMI was found to be protective against DE (aOR 0.86), a relationship that has not been widely reported and warrants further investigation. While obesity is generally considered a risk factor for inflammatory breast diseases, this protective effect may reflect unique population characteristics or confounding factors specific to this cohort.[15]

Additionally, a history of tuberculosis increased the odds of DE threefold (aOR 3.00), suggesting that previous granulomatous infection may contribute to chronic ductal changes, even in the absence of active disease. This is a novel finding, as most studies have focused on excluding active TB, but it is supported by case series from other TB-endemic regions. The presence of caseating granulomas (aOR 2.01) and multinucleated giant cells (aOR 3.50) were also positively associated with DE, indicating a spectrum of granulomatous responses that may overlap with other etiologies or reflect more severe or chronic disease.[16,17]

Conversely, corticosteroid treatment was associated with a significantly reduced likelihood of DE (aOR 0.43). This finding aligns with recent systematic reviews and network meta-analyses, which have shown that corticosteroids, whether used alone or in combination with surgery, are effective in reducing recurrence and ductal complications in GM. The anti-inflammatory effects of corticosteroids may help control ductal inflammation and prevent progression to ectasia.[18,19]

When comparing these findings with other studies, the prevalence of DE among GM patients in this study (19% by histopathology) is comparable to rates reported in recent prospective studies from India and Turkey, where periductal granulomas and ductal changes were frequently observed in GM patients. Sarkar et al. (2023) reported ductal disruption and periductal granulomas in 70% of idiopathic GM cases,

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with duct excision significantly reducing recurrence rates. While the prevalence in the present study is lower, this may be due to differences in diagnostic criteria, population demographics, or healthcare access.[1]

Moreover, the association between prior tuberculosis and DE is a unique contribution of this study. While most research has focused on excluding active TB, the potential for chronic sequelae to influence ductal pathology is increasingly recognized, particularly in high TB-burden settings. This finding underscores the need for thorough evaluation of TB history in patients with GM and DE.[20]

Additionally, the protective effect of corticosteroids against DE is supported by recent meta-analyses, which have demonstrated the efficacy of steroids in reducing recurrence and complications in GM. The low rate of multinucleated giant cells in this cohort contrasts with some Western series but is consistent with findings from Asian populations, where granulomatous responses may vary due to genetic or environmental factors.[21]

STRENGTHS AND LIMITATIONS

Importantly, a major strength of this study is its focus on a coastal, resource-limited population, providing much-needed data from an understudied region. The retro-prospective design and robust histopathological assessment enhance the reliability of the findings. However, limitations include the single-region setting, potential referral bias, and the relatively small number of DE cases, which may limit the generalizability of the results. Additionally, the absence of long-term follow-up data on recurrence and quality of life is a limitation.

CONCLUSION

In conclusion, this study demonstrates a significant association between duct ectasia and granulomatous mastitis in the coastal region of Bangladesh, with age, prior tuberculosis, and specific histopathological features serving as independent predictors. The results support a ductal origin hypothesis for GM and highlight the need for integrated clinical and pathological assessment in resource-limited settings. These insights contribute to a more nuanced understanding of inflammatory breast diseases and inform evidence-based management strategies for affected women in similar contexts.

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