



## Diagnostic and Therapeutic Challenges in Mammary Duct Ectasia: A Clinical Outcome Analysis

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**Abstract:** Background: Mammary duct ectasia (MDE) is a benign inflammatory breast disease often confused with breast carcinoma and is a frequent diagnostic and therapeutic challenge. **Objectives:** To assess diagnostic and therapeutic challenges associated with mammary duct ectasia and to review clinical outcomes following conservative and surgical treatments. **Methods:** This is a descriptive observational study conducted in the Department of General Surgery, MTI, GOMAL Medical College, D.I.Khan between 1 Dec 2023 and 31st July 2024. A total of 95 consecutive patients with mammary duct ectasia were enrolled based on clinical and radiological diagnosis. Demographic features, clinical presentation, imaging characteristics, treatment strategies, and clinical outcomes were noted. SPSS version 26.0 was used for data analysis. Appropriate parametric and non-parametric tests were used, and multivariable logistic regression was performed to identify predictors of surgical intervention and recurrence. **Results:** Most patients came with complaints of nipple discharge and breast pain. The most common diagnostic modality used was ultrasonography, and most patients who were biopsied had a confirmed diagnosis by histopathology. Most cases were treated conservatively, and surgery was indicated for recurrent or persistent disease. Previous breast infection, long duration of symptoms, frequent breast abscess, and nipple inversion were independent risk factors for surgical intervention. The outcomes of the overall symptoms resolution were good, with low postoperative complications and recurrence. **Conclusion:** Mammary duct ectasia can be effectively managed through an individualized approach based on clinical presentation and imaging findings. An early diagnosis and timely intervention will lead to better clinical results, limit the need to perform unnecessary surgery, and patient satisfaction will be high.

**Keywords:** Mammary duct ectasia; Benign breast disease; Nipple discharge; Breast ultrasonography

## INTRODUCTION

Mammary duct ectasia (MDE) is a non-cancerous breast disease defined by enlargement of the larger lactiferous (milk) duct, inflammation around the duct, and progressive scarring.[1] It is more likely to occur

in women in their perimenopausal years, but can happen in younger women as well, and very rarely in males.[2] A very common diagnostic problem in breast clinics, the condition often manifests as nipple discharge, breast pain, nipple inversion, subareolar

mass, or recurrent breast abscess, among other symptoms.[3] The pathogenesis is related to dilatation of the ducts that contain secretions, followed by chronic inflammation and fibrosis, which can cause an alteration of the normal ductal architecture.[4] MDE is a non-cancerous disease that may have a clinical and radiological appearance similar to that of breast carcinoma, which causes uncertainty in diagnosis and anxiety among the patients.[5] Therefore, to avoid unnecessary invasive procedures and to ensure timely management of occult malignancy, accurate differentiation of benign duct ectasia from malignant lesions is crucial.[6]

Breast diseases are a major public health problem globally, and almost 70–80% of breast-related clinical presentations are due to benign breast disorders.[7] MDE is one of the most common causes of pathological nipple discharge in middle-aged women, accounting for 5–9% of all symptomatic benign breast diseases.[8] It is more common in older women, smokers, women who have had breast inflammation, and women who have had more than one pregnancy.[9] Imaging techniques like ultrasonography, mammography, and magnetic resonance imaging have aided in the diagnostic evaluation of MDE, but significant overlap remains between the radiological features of duct ectasia, periductal mastitis, intraductal papilloma, and early breast carcinoma.[10] Imaging studies may yield ambiguous results, or continued symptoms may lead to a suspicion of malignancy, in which case histopathological examination is the gold standard.[11] Therefore, there are often challenges for the clinician to choose the most suitable diagnostic trajectory and to avoid underdiagnosis and overtreatment.

Therapeutic management of MDE is also difficult because the treatment depends on the severity of the disorder, the persistence of the symptoms, and complications that may occur.[12] Many individuals with mild disease can be managed conservatively with antibiotics, pain medication, smoking cessation, and routine follow-up.[13] However, medical therapy often fails, or chronic fistulae form, or recurrent masses develop in the subareolar area, or recurrent abscesses develop, requiring surgery such as microdochectomy or major duct excision.[14] The clinical outcomes of breast imaging and surgical techniques have been greatly improved, but recurrence, delayed wound healing, cosmetic concerns, and patient dissatisfaction remain factors.[15]

The knowledge about the diagnostic accuracy, therapeutic decision-making, and clinical outcomes of MDE is still incomplete, especially in developing countries where delayed presentation and poor

diagnostic facilities can negatively influence the treatment. The majority of studies reported have addressed imaging characteristics or surgical outcomes separately, and detailed analyses that combine clinical presentation, diagnostic evaluation, treatment modalities, and patient outcomes are relatively few. The aim of the present study was thus to investigate the diagnostic and therapeutic difficulties of patients diagnosed with mammary duct ectasia and to evaluate its clinical outcome. The results are likely to offer proof to help the diagnosis earlier, better selection of treatment, and to decrease surgical procedures that may not be necessary in patients with this common benign breast disorder, and to contribute to the development of more effective management strategies for this disorder.

## Methodology

This study was conducted as a descriptive observational study and was carried out in the Department of General Surgery, MTI, GOMAL Medical College, D.I.Khan. The study was done for eight months, from 1st December 2023 to 31st July 2024.

The sample size was calculated using OpenEpi version 3.01 for estimation of a population proportion. In a previous study, 34% of patients with MDE needed surgical intervention after failing conservative treatment. With this anticipated frequency ( $P = 34\%$ ), a 95% confidence level ( $Z = 1.96$ ), and absolute precision ( $d$ ) of 10%, the minimum number of patients required was determined to be 87.[16] In order to make up for incomplete records and potential dropouts, 95 patients were used in the final analysis.

A non-probability consecutive sampling technique was used. In the study, patients were included with the clinical and radiological diagnosis of MDE who were female and aged 18 years or more. Patients who had all diagnostic tests and had conservative or surgical treatment for pathological nipple discharge, breast pain, inverted nipple, subareolar mass, recurrent periductal inflammation, or breast abscess were recruited from the study center. Written informed consent was also obtained from patients who were willing to participate. Patients with histopathologic diagnosis of breast carcinoma, intraductal papilloma, granulomatous mastitis, tuberculosis of the breast, lactational mastitis, traumatic breast lesions, and previous breast malignancy were excluded. Patients who had incomplete clinical records, patients lost to follow-up before treatment outcome assessment, and patients who refused treatment participation were excluded.

Ethical approval was received from the institutional

review board of the respective hospital before the beginning of the study. All participants gave written informed consent before their enrolment. A comprehensive clinical evaluation was done on women with symptoms suggestive of MDE, which included demographic characteristics, medical history, smoking history, parity, menopausal status, duration of symptoms, previous mammary infections, and history of previous breast surgery. An examination of the breast was carried out in detail to document the occurrence of nipple discharge, breast pain, nipple inversion, palpable subareolar mass, breast abscess, and skin changes.

All patients had sufficient radiologic studies, such as breast ultrasonography and mammography, as indicated by the patient's age and clinical presentation. Selective magnetic resonance imaging (MRI) was performed in those patients who had both equivocal imaging data and continued clinical suspicion of underlying malignancy. Clinically, when indicated, a cytological examination of nipple discharge was conducted. Those who had suspicious imaging results or persistent masses were biopsied by either core needle biopsy or an excisional biopsy to obtain a histological diagnosis.

Treatment was tailored to clinical presentation and imaging results. Initial therapy consisted of nonsurgical treatment (antibiotics, analgesics, smoking cessation counseling, and outpatient follow-up) for those with uncomplicated disease. Patients who had recurrent symptoms, persistent pathological nipple discharge, recurrent breast abscess, fistula formation, or failed conservative therapy were

indicated for surgical intervention (microdochectomy or major duct excision) depending on the extent of disease. Patients were followed up until the end of treatment to determine the resolution of symptoms, the presence of postoperative complications, recurrence, cosmetic outcome, and overall clinical outcome. Data collection was done by the principal investigator with a structured and pre-designed proforma for data collection.

Data were collected and analyzed by SPSS (version 26.0). The quantitative variables were summarized as mean  $\pm$  SD or median (IQR) based on the distribution of the data. Presenting symptoms, imaging findings, treatment modality, histopathological diagnosis, postoperative complications, recurrence, and treatment outcome were presented as frequencies and percentages, as they were qualitative variables. Normality of continuous variables was tested by the Shapiro-Wilk test. The associations between categorical variables were tested by the Chi-square test and Fisher's exact test. The independent-samples t-test and Mann-Whitney U test were used to compare continuous variables depending on the distribution of data. A multivariable binary logistic regression analysis was conducted to determine potential independent factors associated with the decision for surgical intervention and disease recurrence, after controlling for other possible confounding factors. The p-value was regarded as statistically significant at  $< 0.05$  for two-tailed values.

## Results

A total of 95 patients with mammary duct ectasia were included in the study. The mean age of the subjects was middle age, and there was a variable duration of symptoms before their presentation. The majority of patients were multiparous, smoking, and previous breast infection and prior breast surgery were observed in a lesser number of patients. The most common clinical manifestations were nipple discharge, breast pain, palpable subareolar mass, nipple inversion, recurrent breast abscess, erythema of skin, and formation of a fistula. (Table 1).

Radiological evaluation showed ultrasonography to be the most commonly used imaging modality and features suggestive of mammary duct ectasia in most of the patients. Magnetic resonance imaging and cytological examination were only performed in selected cases, while mammography was carried out based on age and clinical indications. In the majority of patients who had a biopsy, the diagnosis was confirmed by histopathological examination. Conservative treatment was successful for over half of the patients, and surgical treatment was necessary for the others. Clinical results were satisfactory, including the resolution of symptoms, low postoperative morbidity, small recurrence, and satisfactory cosmetic results after treatment. (Table 2).

Data distribution of age and follow-up duration were assessed with the Shapiro-Wilk test, which revealed that age and follow-up duration were normally distributed, while the duration of symptoms was non-normally distributed. Thus, parametric and non-parametric statistical tests were used as appropriate in comparative analyses. (Table 3). Several baseline characteristics and disease-related factors were significantly different between the patients treated conservatively and those treated with surgery. Those patients who needed surgery tended to have longer durations of symptoms and more severe clinical characteristics. Overall, there were no significant differences between the treatment groups in terms of symptom resolution or recurrence of the disease, showing that both management strategies can be effective when used as appropriate. (Table 4).

The results of multivariable binary logistic regression analysis showed that age, smoking, previous breast infection, duration of symptoms, recurrent breast abscess, and nipple inversion were independent predictors of surgical intervention. These variables were still statistically significant following adjustments for potential confounding factors. (Table 5).

To evaluate predictors of disease recurrence, further regression analysis was performed, showing that, during follow-up, smoking, previous breast infection, and delayed wound healing were independent factors. In contrast, neither type of treatment nor length of illness was an independent predictor after adjusting for multiple factors. (Table 6).

**Table 1. Baseline Demographic and Clinical Characteristics of Patients with Mammary Duct Ectasia (n = 95)**

| Variable                                    | Value          |
|---------------------------------------------|----------------|
| Age (years), Mean $\pm$ SD                  | 46.8 $\pm$ 9.4 |
| Duration of symptoms (months), Median (IQR) | 5 (3–9)        |
| Follow-up duration (months), Mean $\pm$ SD  | 6.5 $\pm$ 1.4  |
| Smoking history                             | 28 (29.5%)     |
| Multiparity                                 | 69 (72.6%)     |
| Postmenopausal                              | 37 (38.9%)     |
| Previous breast infection                   | 24 (25.3%)     |
| Previous breast surgery                     | 11 (11.6%)     |
| Nipple discharge                            | 73 (76.8%)     |
| Breast pain                                 | 61 (64.2%)     |
| Palpable subareolar mass                    | 42 (44.2%)     |
| Nipple inversion                            | 26 (27.4%)     |
| Recurrent breast abscess                    | 19 (20.0%)     |
| Skin erythema                               | 17 (17.9%)     |
| Fistula formation                           | 9 (9.5%)       |

**Table 2. Diagnostic Evaluation and Treatment Characteristics of the Study Population (n = 95)**

| Variable                                                             | n (%)     |
|----------------------------------------------------------------------|-----------|
| Radiological Evaluation                                              |           |
| Ultrasound suggestive of duct ectasia                                | 82 (86.3) |
| Mammography performed                                                | 68 (71.6) |
| Mammography suggestive of duct ectasia*                              | 52 (76.5) |
| MRI performed                                                        | 14 (14.7) |
| Cytology of nipple discharge performed                               | 39 (41.1) |
| Core needle/excisional biopsy performed                              | 33 (34.7) |
| Histopathology confirmed mammary duct ectasia**                      | 30 (90.9) |
| Other benign pathology**                                             | 3 (9.1)   |
| Treatment Modalities                                                 |           |
| Conservative management                                              | 56 (58.9) |
| Surgical management                                                  | 39 (41.1) |
| • Microdochectomy***                                                 | 24 (61.5) |
| • Major duct excision***                                             | 15 (38.5) |
| Clinical Outcomes                                                    |           |
| Complete symptom resolution                                          | 82 (86.3) |
| Postoperative wound infection                                        | 5 (5.3)   |
| Delayed wound healing                                                | 4 (4.2)   |
| Disease recurrence                                                   | 11 (11.6) |
| Satisfactory cosmetic outcome                                        | 88 (92.6) |
| *Percentage calculated among patients undergoing mammography (n=68). |           |
| **Percentage calculated among biopsied patients (n=33).              |           |
| ***Percentage calculated among surgically treated patients (n=39).   |           |

**Table 3. Assessment of Normality of Continuous Variables Using the Shapiro–Wilk Test**

| Variable             | W Statistic | p-value | Distribution |
|----------------------|-------------|---------|--------------|
| Age                  | 0.981       | 0.192   | Normal       |
| Follow-up duration   | 0.973       | 0.084   | Normal       |
| Duration of symptoms | 0.901       | <0.001  | Non-normal   |

**Table 4. Comparison Between Conservative and Surgical Management Groups**

| Variable                           | Conservative (n=56) | Surgical (n=39) | p-value |
|------------------------------------|---------------------|-----------------|---------|
| Age (years), Mean $\pm$ SD         | 44.7 $\pm$ 8.6      | 49.9 $\pm$ 9.8  | 0.008   |
| Duration of symptoms, Median (IQR) | 4 (2–6)             | 8 (5–12)        | <0.001  |
| Smoking history                    | 11 (19.6%)          | 17 (43.6%)      | 0.011   |
| Previous breast infection          | 9 (16.1%)           | 15 (38.5%)      | 0.014   |
| Nipple inversion                   | 10 (17.9%)          | 16 (41.0%)      | 0.012   |
| Recurrent breast abscess           | 6 (10.7%)           | 13 (33.3%)      | 0.006   |
| Complete symptom resolution        | 49 (87.5%)          | 33 (84.6%)      | 0.682   |
| Disease recurrence                 | 4 (7.1%)            | 7 (17.9%)       | 0.102   |

**Table 5. Multivariable Binary Logistic Regression Analysis for Predictors of Surgical Intervention**

| Variable                       | Adjusted OR | 95% CI     | p-value |
|--------------------------------|-------------|------------|---------|
| Age >45 years                  | 1.89        | 1.01–3.84  | 0.048   |
| Smoking history                | 2.74        | 1.18–6.39  | 0.019   |
| Previous breast infection      | 2.58        | 1.10–6.06  | 0.029   |
| Duration of symptoms >6 months | 3.81        | 1.62–8.96  | 0.002   |
| Recurrent breast abscess       | 4.52        | 1.64–12.41 | 0.003   |
| Nipple inversion               | 2.29        | 1.01–5.18  | 0.046   |

**Table 6. Multivariable Binary Logistic Regression Analysis for Predictors of Disease Recurrence**

| Variable                       | Adjusted OR | 95% CI     | p-value |
|--------------------------------|-------------|------------|---------|
| Smoking history                | 3.12        | 1.08–9.04  | 0.035   |
| Previous breast infection      | 2.86        | 1.01–8.11  | 0.048   |
| Surgical management            | 1.74        | 0.61–4.98  | 0.304   |
| Delayed wound healing          | 4.83        | 1.28–18.29 | 0.020   |
| Duration of symptoms >6 months | 2.41        | 0.89–6.51  | 0.083   |

## DISCUSSION

MDE is a problem that is still a challenge in diagnosing and treating, as its clinical symptoms often overlap with malignant breast diseases. The most common patient population in the current study included middle-aged female patients with nipple discharge and breast pain, and the associated factors were multiparity and breast infection. The results are similar to the case-control study by Salah et al. (2026), who found that MDE is mostly seen in multiparous women and is often associated with nipple discharge, mastalgia, and previous lactation.[17] These factors of obesity, smoking, and reproductive factors were also found to be significant in the onset of the disease in their study, which corroborates our clinical observations of obesity, smoking, and reproductive factors.

This study showed that ultrasonography was the major diagnostic tool used, and mammography and magnetic resonance imaging (MRI) were only used when the results of ultrasonography were not clear-

cut. Histopathological examination confirmed the diagnosis in almost all of the cases that were biopsied, highlighting the importance of excluding breast malignancy. The same was also noted by studies, which emphasized the usefulness of breast ultrasonography as the recommended initial investigation, as it has a high sensitivity in detecting ductal changes and inflammatory changes, while histopathology is required whenever there is a suspicion that the imaging results suggest a malignancy or the presence of symptoms has persisted.[18, 19]

Conservative treatment was successful in more than 50% of our patients, and surgery was performed in cases where medical management did not provide an adequate response, recurrent abscesses, and/or persistent symptoms. These results are in line with the study conducted by Grabowski et al. (2026), which showed that conservative treatment is effective for uncomplicated disease, whereas central duct excision is the preferred treatment for recurrent or persistent MDE.[20] They also stated that they achieved their clinical results and had very low complication rates,

similar to the good clinical results we saw.

In our study, the percentage of overall symptom resolution rate was high, and the rate of recurrence after individualized treatment was relatively low. The findings are similar to those of Rahim et al. (2026), who recommended that the management be adjusted based on the disease stage: conservative management for early disease and surgical removal for abscess, fistula, or recurrent disease.[21] The study also highlighted that delay in treatment will increase the risk of recurrence and the formation of chronic fistula, which corroborates our findings with regard to the importance of prolonged symptom duration as a determinant of surgical management.

Smoking was found to be an independent risk factor for surgery and for disease recurrence in the current study. EV et al (2026) were able to show a significant relationship between smoking and mammary duct ectasia, indicating that smoking plays a role in chronic periductal inflammation, epithelial damage, and recurrent disease.[22] The mechanism is believed to be due to toxic injury to the ductal epithelium, resulting in inflammatory fibrosis and duct obstruction.

In our study, previous breast infection and recurrent breast abscess were also major factors in the need for surgical treatment. Similarly, Ahmed et al. (2024) presented a retrospective study on the association between chronic inflammatory breast disease, duct ectasia and recurrent inflammatory episodes in Bangladesh, and found a close association between the two.[2] The authors proposed that chronic inflammation would be a driver of progressive destruction and fibrosis of the ductal system, leading to an increased risk of operative intervention.

The duration of symptoms was significantly longer for patients who had surgery compared with those who presented earlier in our cohort. This finding is consistent with Hossain et al. (2026), who reported that conservative treatment was less effective if the diagnosis was delayed until the discharge stage, to the point of abscess and fistulae formation, and required more surgical duct excision.[23]

The overall results from the present study align with the most recent available evidence, which corroborates MDE as a mostly benign but sometimes highly challenging condition for diagnosis. When early diagnosis, suitable imaging, selective histopathological diagnosis, individual treatment planning, and early surgical intervention for refractory disease are used, the clinical outcomes will be excellent without unnecessary procedures and with minimal recurrence. The value of the identification of modifiable risk factors, especially smoking and

recurrent breast infection, to achieve the best long-term outcomes is further confirmed by our data.

## CONCLUSION

MDE is a benign disorder of the breast, but an important one, which is extremely difficult to diagnose and treat due to its similarity with breast malignancy. The main diagnostic modalities were ultrasonography, and in selected cases, histopathological examination was mandatory to rule out malignancy. Most patients were treated conservatively, and these patients responded well; however, those who did not respond well, including breast abscesses, long duration of symptoms, smoking, and previous breast infection, were associated with a higher risk of surgery. General findings were good clinical results with high symptom resolution and low rates of complications and recurrence with individualized treatment. An early diagnosis, careful patient selection, and timely intervention are vital to achieve the best treatment outcomes and avoid unnecessary surgical procedures.

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