

# Modified Techniques Versus Hadfield's Procedure in Patients With Periductal Mastitis

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## Research Article

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# Abstract

**Background:** Periductal mastitis (PM) is a rare disease characterized by chronic inflammation of the terminal mammary ducts. Complete removal of the terminal canals with Hadfield's operation applied in the treatment carries various complication risks. This study is designed to evaluate the effectiveness of modified techniques and compare them with the Hadfield operation.

**Methods:** Twenty women who underwent surgery due to PM between January 2012 and December 2019 were retrospectively analyzed. Types of PM were determined. All patients were operated on with three different incisions (Hadfield's operation with periareolar incision, periareolar combined with radial incision, and round block incision).

**Results:** The age mean  $37.5 \pm 6.5$  years (range:24-49). Sixty percent of patients had type three PM. For the affected duct excision, a classic Hadfield's operation with periareolar incision was performed in 11 patients, periareolar incision combined with radial incision was performed in 7 patients. The round block method was performed on two patients. Seroma was observed in only one of the patients who underwent the modified technique. In Hadfield's procedure, NAC retraction (n:2), seroma (n:1), and hematoma (n:1) were seen. The follow-up period was  $12 \pm 1.5$  months. Recurrence occurred in two patients, and both had Hadfield's procedures.

**Conclusions:** The main principle of surgical treatment is excision of the affected canal with a clear margin. In PM treatment, The round block method and periareolar incision combined radial incision modifications of the Hadfield procedure reduce complications and recurrence risk.

## Introduction

Periductal mastitis (PM) is a benign disease affecting a terminal lactiferous duct responsible for 1–2% of all symptomatic breast conditions. Clinically, non-cyclic mastalgia, nipple discharge, nipple-areola complex (NAC) retraction, subareolar breast mass with or without mastitis, periareolar abscess, or often lactiferous duct's fistula can be seen [1]. The disease was first defined by Birkett [2] as the "morbid condition of the lactiferous duct" in 1850; later, in 1923, Bloodgood [3] reported that lactiferous duct enlargement and periductal inflammation take an important place in the pathogenesis. In 1951, it was defined by Zuska et al. [4] as "mammary fistula" and was referred to as Zuska's disease in the literature.

The disease's pathogenesis is complicated, but the major pathologic finding is squamous metaplasia that acts on epithelial cells. The disease begins with periductal inflammation that develops due to the obstruction of subareolar lactiferous ducts by keratinous plaques. This inflammation causes duct rupture and periareolar fistula development [4, 5].

In the treatment, surgery, which is accepted as the Hadfield procedure, including removing the main lactiferous canals, primary closure of the fistulectomy, and nipple reconstruction, is performed [6].

However, NAC necrosis, nipple retraction, and postoperative infection are potential complications of this operation [7].

There are no comparative articles for different surgical techniques in the literature. In our study, we tried to compare the effectiveness of modified strategies techniques, which we performed on PM.

## Methods

We reviewed 20 women with PM who, between January 2012 and December 2019, underwent surgery at the Cukurova University Balcalı Hospital.

### Data Collection

Detailed medical history was taken in all patients. Demographic characteristics of patients, comorbidities, previous treatment attempts and medications, etiologic risk factors (smoking history, usage of a tricyclic antidepressant, prolactinoma, and systemic lupus erythematosus), and a recurrent breast abscess with a periareolar skin opening and communication with the lactiferous duct had examined (Fig. 1). Incision type of the performed surgery, cosmetic results of surgery (nipple retraction after surgery), and recurrence rates were analyzed.

### Preoperative Evaluation

Breast ultrasonography was performed in all patients. Patients over the age of 40 were also evaluated by digital mammography. If the breast cancer could not be distinguished, magnetic resonance imaging was also performed.

### Clinical Classification

The PM classification defined by Zhang et al. [8] was used (Table 1).

Table 1  
Classification of PM

Type	Findings	Descriptions	n, (%)
Type I	Mass	Breast mass without abscess or fistula	4 (20%)
Type IIa	Small abscess	Breast mass with small ( $\leq 3$ cm) abscess	1 (5%)
Type IIb	Big abscess	Breast mass with big ( $> 3$ cm) abscess	1 (5%)
Type III	Fistula	Ductal fistula with or without breast mass	12 (60%)
Type IV	Complex or refractory	Breast mass with abscess and fistula	2 (10%)

### Surgical Technique

All surgical procedure was carried out with general anesthesia by surgeons that were specialized in the field of breast diseases. A routine prophylactic antibiotic (Cefazolin Sodium 2 gr.) was administered.

Three surgical procedures were performed to remove the affected duct. (i) Periareolar incision (classic Hadfield operation), (ii) periareolar incision combined with a radial incision, (iii) Round block incision (Fig. 2,3).

After determining the duct's tract affected by palpation in all patients, the criteria we considered in the incision selection were as follows. The classic Hadfield operation with periareolar incision was preferred if the affected duct is in the periareolar region. If the affected duct started from the NAC and lay down too far, we chose a periareolar combine radial incision. The round block incision was preferred in big-volumed breasts, and if the fistula tract is unclear or a large excision defect will occur.

The nipple is elevated off the underlying breast tissue. Then, a cone of breast tissue containing the affected ducts was excised. Post-excision volume displacement was performed with glandular flaps to avoid NAC inversion. 2/0 polyglactin was used for glandular tissue approximation, and 3/0 polyglactin was used for subcutaneous tissue closure. All skin incisions were closed subcuticular with 4/0 polyglycapron. Postoperatively, oral preparations of 500 mg of cefuroxime twice daily for seven days were administered.

### **Histopathologic evaluation**

The histopathologic features investigated were metaplastic changes in the cuboidal epithelium to the squamous epithelium, ducts obstruction by keratin plugs non-granulomatous inflammation, which was rich in plasma cells and macrophages. The definitive diagnosis of PM was confirmed histopathologically in all patients (Fig. 4).

### **Follow-up**

All patients were followed regularly at one week, three months, six months and one year in some, and the relapse and NAC retraction were checked in all.

### **Statistical analysis**

Continuous variables were described as the mean  $\pm$  standard deviation. Categorical variables were defined as the number (%).

## **Results**

All of the 20 patients were female. Their median age was  $37.5 \pm 6.5$  years (ranging from 24 to 49). In fourteen cases, the disease was located in the right breast. Eight patients who were referred to our clinic had undergone at least one abscess drainage before admission. It was found that corticosteroid treatment was started in two of these patients with a misdiagnosis of idiopathic granulomatous mastitis

in another center. Nine patients were multipara. When possible etiological risk factors for PM are examined, sixteen patients were smokers, one patient has systemic lupus erythematosus (SLE), and two were users of tricyclic antidepressants (Table 2).

Table 2  
Clinical and demographic features of the patients

Variable	n, (%)
Lateralization	
Right	14 (70%)
Left	6 (30%)
Gravidity	
Nullipara	4 (20%)
Unipara	7 (35%)
Multipara	9 (45%)
Previous Surgery	
No	12 (60%)
Abscess drainage	8 (40%)
Etiologic Risk Factors	
Smoking	16 (80%)
Tricyclic antidepressant	2 (10%)
Prolactinoma	0 (0%)
SLE	1 (5%)

Sixty percent of patients (n:12) had type three PM (Table 1). The surgical procedures applied to the patients are given in Table 3. As the surgical procedure, a classic Hadfield operation with periareolar incision was performed on 11 patients, periareolar incision combined radial incision was performed in 7 patients, and Round Block incision was performed in 2 patients.

Table 3  
Relationship of surgical procedures with types, complications, and recurrence

	<b>Hadfield procedure with periaerolar incision (n:11)</b>	<b>Periareolar combined radial incision (n:7)</b>	<b>Round block incision (n:2)</b>
<b>Types</b>			
Type I	2	2	0
Type IIa	1	0	0
Type IIb	1	0	0
Type III	6	5	1
Type IV	1	0	1
<b>Complication</b>			
NAC retraction	2	0	0
Seroma	1	1	0
Hematoma	1	0	0
NAC necrosis	0	0	0
<b>Recurrence</b>			
Yes	2	0	0
No	9	7	2

Seroma was observed in only one of the patients who underwent the modified technique. In Hadfield's procedure, NAC retraction (n: 2), seroma (n: 1), and hematoma (n: 1) were seen. None of our patients had complications of NAC necrosis.

Recurrence occurred in two patients at  $12 \pm 1.5$  months of follow-up, and both had Hadfield's procedure. Recurrence occurred in two patients at  $12 \pm 1.5$  months of follow-up, and both had Hadfield's methods (Table 3). One of these patients was treated with re-resection and the other with negative pressure wound therapy.

## Discussion

Although more than 100 years have passed since the disease's definition, there are still controversies in diagnosis, classification, and treatment. Some studies investigating the relationship between PM and smoking revealed that the amount of nicotine in the subareolar duct was higher than plasma [8, 9, 10]. In

normal breast tissues, lactiferous ducts are lined by a two-layer cuboidal epithelium, and the orifices on the nipples are lined with squamous epithelium. As a result of the cuboidal epithelium's metaplasia to squamous epithelium, keratin plugs are formed inside the duct. The keratin plugs cause enlargement and rupture of the ducts leading to periductal inflammation and fistula development. Smoking is a known risk factor accelerating the development of such metaplasia [11]. Most of the PM cases in our study group were smokers (80%), as stated in the literature. Tricyclic antidepressant drugs inhibit dopamine secretion, thus suppressing the inhibitive effect of dopamine on prolactin secretion and might lead to hyperprolactinemia [12]. Hyperprolactinemia causes hyperplasia of the epithelium in the ducts and increases lipid- and protein-rich secretions. These secretions might lead to the terminal mammary duct's obstruction and could develop PM [13]. Besides lactation and Tricyclic antidepressants, such autoimmune diseases as SLE, Rheumatoid Arthritis, and Sjogren's syndrome were recorded to might cause hyperprolactinemia [14]. One patient in our series had an SLE diagnosis, and two had a history of tricyclic antidepressant use. But none of our patients had a prolactinoma.

For the first time, Zhang et al. put forward a category [15]. We grouped our patients according to their classification system, and Type 3 PM was the most common in our series. We think that this classification will be useful in determining the extent of surgery is performed.

Abscess drainage and antibiotic therapy without fistulotomy are not sufficient in PM treatment. Versluijs-Ossewaarde et al. reported a recurrence rate of 79% among patients suffering from subareolar abscess treated without excision of the terminal duct [16]. The treatment of PM includes several principles: resection of the ampulla and its abscess, a fistulectomy, reconstruction of the nipple-areola, and correction of the nipple inversion [11, 17, 18]. In 1960, Hadfield described a surgical technique for excision of the major duct system for benign disease of the breast [6]. This procedure is often used in ductal ectasia or intraductal papilloma conditions and includes a periareolar incision to remove the terminal ducts. However, the complete excision of the breast's terminal ductal system is associated with several complications, such as nipple retraction and necrosis of NAC [7]. Taffurelli et al. presented 18 cases of PM treated with Hadfield's procedure using a probe to find the fistula's location. Although they reported good cosmetic results, they found that recurrence developed in 11% of cases [1]. In our series, 11 patients underwent the Hadfield's procedure, and recurrence developed in 2 of them. Moreover, complication rates were higher than other modified techniques.

Various modified surgical treatments have been reported in the literature for the PM to reduce complications and recurrence risk [19]. Menguid et al. has preferred only radial incision, which started from the middle of the NAC to encompass the diseased duct and extended laterally through the areolas and the lateral border. There was no recurrence on the side where the ductus was excised in their 24 patients. However, new fistulas developed in 4 patients in other quadrants, so they performed complete ampulla resection in a second surgery [20]. In another article by Komenaka et al., a combined incision of periareolar and radial incision was performed in 15 cases [21]. They found no recurrence at the same localization in the follow-up, but new fistulas developed at another quadrant in two patients. In our series,

we preferred the periareolar combined radial incision in 7 patients, and we did not observe recurrence or new fistula development in any of them.

Different treatment methods in PM treatment are not limited to the choice of an incision. Some authors leave the wound to secondary healing. Beechey-Newman performed fistulectomy and saucerization with healing by secondary intention on 53 patients; however, they found an 8% recurrence rate [22]. Some surgeons prefer wide excision. But this may require flap reconstruction for closing the defect. Zhang et al. reported a recurrence rate of 4.3% in their series of 47 patients in which they close the defect after excision with dermo-glandular flap [23]. It is known that NAC retraction or necrosis is feared after such surgeries. Al Masad performed the NAC advancement as a flap into a new bed immediately above the incision across the upper half of the areola-skin junction in 33 patients. He found loss of sensation in 4%, epithelial necrosis of the upper half of the areola in 2%, and recurrence of discharge in 2% [7].

However, as seen, none of the authors stated that they used the round block method in PM's treatment. This method is often used on oncoplastic breast-conserving surgery for central tumors [24]. As far as we know, this study is the first article to report that the round block method can be used in the treatment of PM, and we would like to note that there was no recurrence in the two patients we treated with this method. According to our limited experience, round block and periareolar combined radial incision give better results in Types 2b, 3, and 4 PM. Because these patients have a larger abscess space or a longer fistula tract, extensive exposure is required. The classic Hadfield's operation with a periareolar incision does not provide such extensive exposure. We think these were because we performed large excision when we use these modified procedures, and we could achieve better volume displacement.

## Limitations

Our low number of patients is the main limitation of our study due to the disease's low incidence. Therefore, we could not make advanced statistical comparisons. The other limit is that our research was retrospective. A more extensive series or multicenter studies are required.

## Conclusion

Different surgical procedures may be preferred for the removal of terminal lactiferous duct on PM. Despite our limited number of patients, we observed that the round block or periareolar combined radial incision made a more extensive exposure, so we achieved fewer complications and recurrence rates.

## Declarations

**Acknowledgements:** We are grateful to all study participants for their participation in the study.

**Author contributions:** SG, KD, AGS, and MOG designed the study, collected data, and performed the literature search. KD, ATA, and SG wrote the article. ME, GS, AU, and AR made the critical revisions.

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## Declarations

- **Ethics approval and consent to participate:** This study was approved by the Institutional Review Board of Cukurova University Faculty of Medicine (No. January 10, 2020/ 95-27), and written informed consent statement was taken from every patient who registered into the study. It has been performed by the ethical standards laid down in the Declaration of Helsinki.

- **Consent for publication:** Written informed consent statement for publication was taken from every patient who registered into the study.

**Availability of data and materials:** The data that support the findings of this study are available from the corresponding author upon reasonable request

**Disclosure of conflict of interest:** The authors declare that they no conflict of interest.

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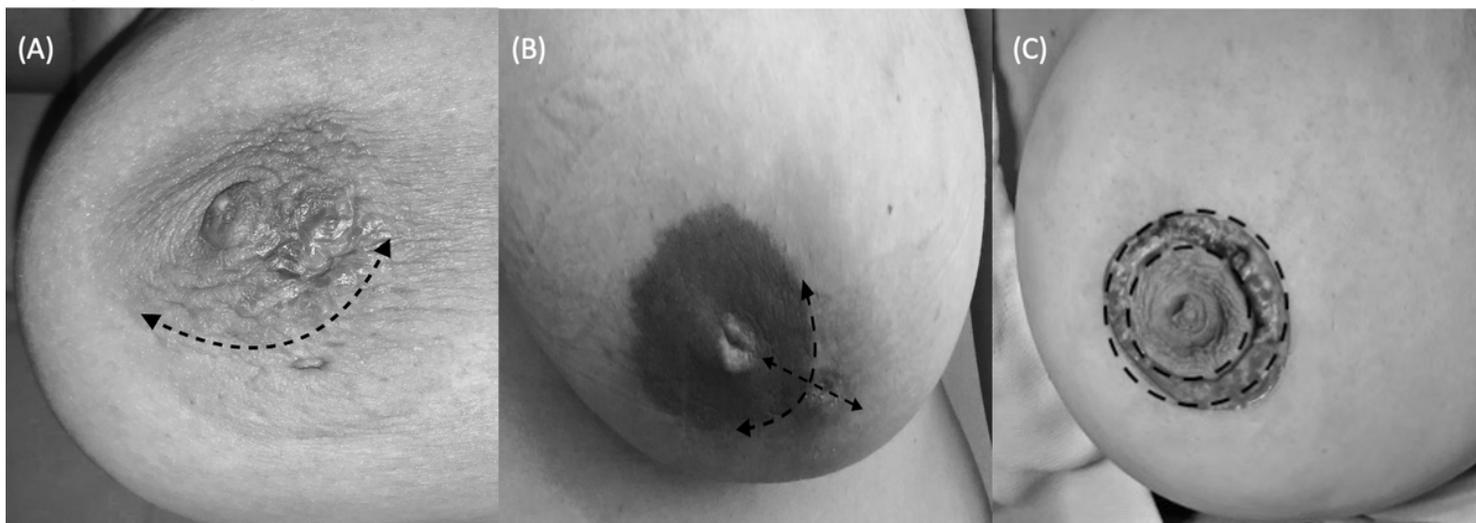
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## Figures



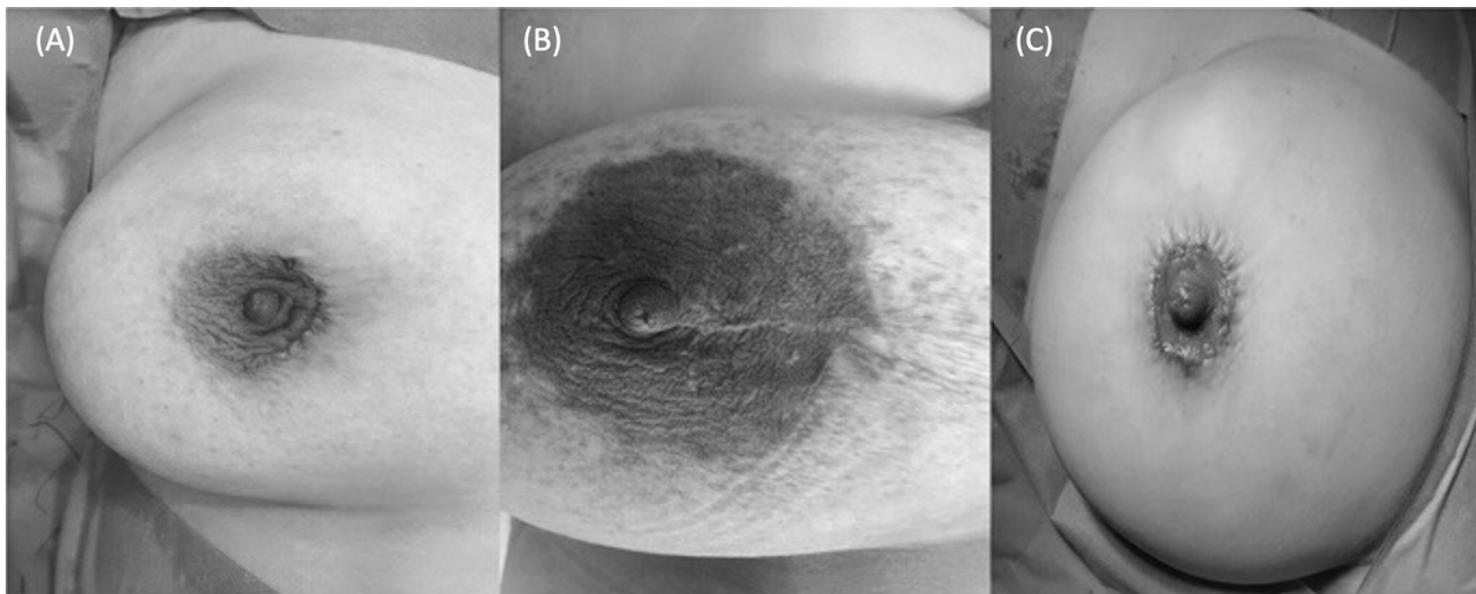
Figure 1

Preoperative image of PM. The fistula located in the left breast at 5 clockwise.



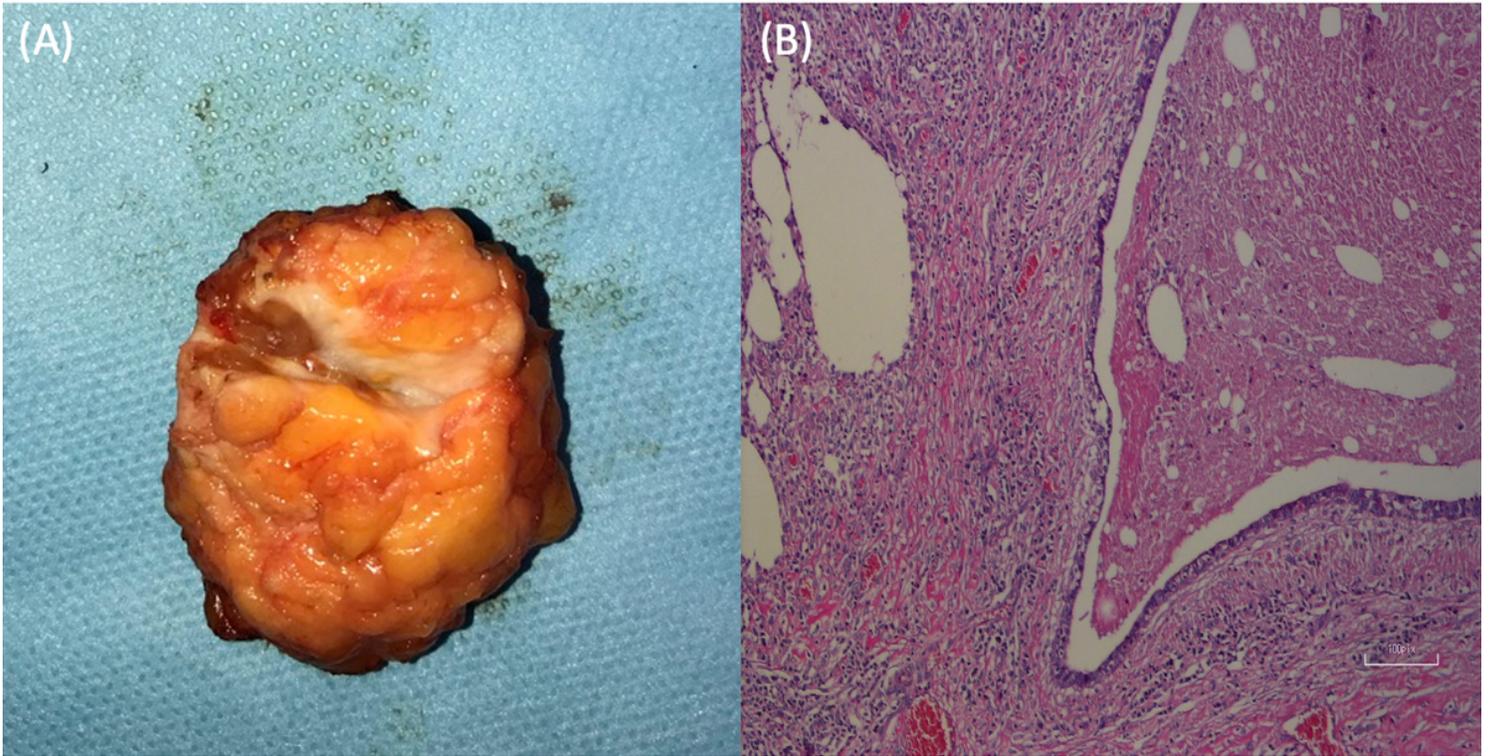
**Figure 2**

Incision Types A. Periareolar incision for Hadfield's operation B. Radial incision combined with periareolar incision. C. Round block incision.



**Figure 3**

Postoperative images A. Periareolar incision was performed. B. Radial incision combined with periareolar incision was performed C. Round block incision performed.



**Figure 4**

Histopathologic elevation A. Macroscopic imaging of the excised duct. B. Microscopic imaging: The central duct is dilated and filled with thick secretions and there is a surrounding cuff of chronic inflammation in the periductal stroma (Stained with Hematoxylin and Eosin).