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High-Risk Factors for Suppurative Mastitis in Lactating Women

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Background: Acute mastitis is a common disease occurring in postpartum lactating women. This study aimed to identify the high-risk factors for suppurative mastitis (SM) in women who were breastfeeding.





Material/Methods: A total of 262 non-SM patients and 63 SM patients admitted to the Department of Breast and Thyroid Surgery of Liaocheng People's Hospital were retrospectively enrolled in this study. The high-risk factors for SM during lactation were determined by assessing admission time after acute mastitis, galactostasis, primipara or pluripara, nipple injuries, antibiotic treatment course, and diabetes.

Results: The incidence of SM in patients with admission time greater than 72 h after occurrence of acute mastitis was significantly higher than that in patients whose admission time was less than 72 h ($p < 0.0001$). Patients with galactostasis were more prone to develop SM compared to patients without galactostasis ($p < 0.0001$), and the incidence of SM in primiparous patients was significantly higher than that in pluriparous patients ($p = 0.003$). The incidence rate of SM was significantly higher in patients with diabetes than in patients without diabetes ($p = 0.002$). Patients with nipple injuries were more prone to suffer from SM relative to the patients without nipple injuries ($p < 0.0001$). However, there was no significant difference in the incidence of SM according to the antibiotic treatment course ($p = 0.134$).

Conclusions: SM during lactation was closely associated with admission time after the occurrence of acute mastitis, galactostasis, primipara, diabetes, and nipple injuries.

MeSH Keywords: **Breast Feeding • Inflammation • Mastitis**

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Background

Acute mastitis is a common disease with a higher incidence in breastfeeding women [1,2]. Acute mastitis is generally caused by incorrect breastfeeding, lack of breastfeeding experience, and poor drainage of breast milk, resulting in accumulation of breast milk and subsequent bacterial infection [3]. Patients with non-suppurative mastitis (acute simple mastitis) have multiple manifestations of breast tenderness, with a high skin temperature of the breast and indurative mammary glands [4]. Acute suppurative mastitis (SM) affects the health of mothers and their babies. The clinical manifestations acute SM include red, swollen, hot, and tender breast, with breast tenderness being more obvious, and the patient may be shivering with high fever, headache, and weakness [5]. Swollen lymph nodes can be observed in the armpit, with an increased inflammatory cell count, which can progress to sepsis in severe cases, affecting the normal feeding of infants [6]. The formation of abscesses in patients with acute SM is due to inadequate treatment or further aggravation of the disease, tissue necrosis, liquefaction, and infections [7]. Abscesses can be single or multilocular. Superficial abscesses are easy to locate, but deep abscesses are less visible.

The treatment approaches for acute non-SM include: promoting the discharge of milk to alleviate silting-up of the breast [8]; hot compresses on the breast to help relieve breast swelling and pain [8,9]; and controlling inflammation by antibiotics [10]. However, for patients with SM, in addition to the above treatment approaches, a surgical incision should be performed as early as possible to drain the pus [11]. Therefore, determining the high-risk factors for SM during the breastfeeding period would be of great clinical significance. In this study, we retrospectively analyzed the clinical data of 325 breastfeeding women, including non-SM patients (262 cases) and SM patients (63 cases), and determined the high-risk factors for SM in the breastfeeding women, providing guidance for prevention and early treatment of SM.

Material and Methods

Ethics statement

This study was conducted in accordance with the Helsinki Declaration of the World Medical Association. All treatment procedures in this study were approved by the Ethics Committee of Liaocheng People's Hospital, Shandong, China. This study only involved a retrospective review of the clinical data, and all patients signed informed consent before enrollment.

Patients

A total of 325 breastfeeding women, including 262 cases of non-suppurative mastitis (SM) patients and 63 cases of SM patients,

admitted to the Department of Breast and Thyroid Surgery of Liaocheng People's Hospital (Liaocheng, China) from January 2013 to January 2017, were included in the study. Disease diagnoses were made based on previous disease histories, clinical symptoms, and laboratory examinations.

Inclusion criteria for non-SM (acute simple mastitis) were: patients with breast swelling and pain, red skin color, no breast abscess formation, and systemic symptoms such as chills, fever, and headache. With routine conservative treatment, the breast masses and pain disappeared, and body temperature, lactation, and inflammatory cell counts were returned to normal levels.

Inclusion criteria for SM were: patients with high fever, chills, breast redness and tenderness, breast abscess formation, and poor response to conventional conservative treatment. With incision and drainage, the patients were cured, and purulent outflow was seen following incision and drainage.

Exclusion criteria were: patients with respiratory tract infections, gastroenteritis, cholecystitis, encephalitis, or other infectious diseases; and patients with severe heart disease, kidney disease, liver disease, blood disease, or tumors.

Treatment

Non-SM patients were treated with conventional conservative therapy, including negative-pressure suction to promote breast milk discharge, physical cooling (32–36°C warm-water bath for 15 min every 2 h; room temperature maintained at ~20°C; drinking water), hot compress applied to the breast (30 min 3 times daily) to promote breast swelling and pain relief; and intravenous penicillin to combat infection (4 million units twice a day, Harbin Pharmaceutical Group Co., Ltd., drug production lot number H23021440). For patients with SM, all the above conventional conservative therapies plus incision and drainage were used.

Variables

The incidence of SM according to the admission time after the occurrence of acute mastitis, breast deposition, nipple injury, primipara, diabetic status, and antibiotic treatment course was statistically analyzed in the non-SM and SM patients.

Statistical analysis

SPSS 17.0 statistical software (SPSS, Chicago, Illinois, USA) was used for statistical analysis. The enumeration data were expressed as number and the comparison between the 2 groups was performed by the chi-square (χ^2) test. Differences were considered as statistically significant when *p*-values were less than 0.05.

Table 1. Comparison of the incidence of SM according to the admission time after the occurrence of acute mastitis.

	Number (n)	≤72 h (n)	>72 h (n)
Non-SM	262	178	84
SM	63	12	51
χ^2			49.992
<i>P</i>			<0.0001

Non-SM – non-suppurative mastitis.

Table 2. Comparison of the incidence of SM according to galactostasis.

	Number (n)	Non-galactostasis (n)	Galactostasis (n)
Non-SM	262	215	47
SM	63	9	54
χ^2			108.918
<i>P</i>			<0.0001

Non-SM – non-suppurative mastitis.

Table 3. Comparison of the incidence of SM between primiparous and pluriparous women.

	Number (n)	Primipara (n)	Pluripara (n)
Non-SM	262	197	65
SM	63	58	5
χ^2			8.556
<i>P</i>			0.003

Non-SM – non-suppurative mastitis.

Results

Comparison of the incidence of SM according to the admission time after the occurrence of acute mastitis

As shown in Table 1, the incidence of SM patients was 37.78% (51/135) when the admission time after the occurrence of acute mastitis was more than 72 h. This rate was significantly higher than that of patients whose admission time was less than 72 h after occurrence (6.32%; 12/190; $p < 0.0001$). Through comparison of the admission times, we found that the majority of patients with SM were admitted to the hospital more than 72 h after the occurrence of acute mastitis. By then, the optimal treatment time was lost, leading to the high incidence of SM.

Comparison of the incidence of SM according to galactostasis

Galactostasis was prevalent in SM patients, and the incidence rate of SM in patients with galactostasis was 37.78% (54/101),

which was significantly higher than that in patients without galactostasis (4.02%; 9/224) ($p < 0.0001$) (Table 2).

Comparison of the incidence of SM in primiparous and pluriparous women

As shown in Table 3, the incidence of SM in primiparous women was 22.75% (58/255), which was significantly higher than that in pluriparous women (7.14%; 5/70) ($p < 0.0001$).

Comparison of the incidence of SM according to the antibiotic treatment course

For the patients whose course of antibiotic treatment was more than 7 d, the incidence of SM was 20.33% (61/300). However, for the patients treated with antibiotics for less than 7 d, the incidence rate of SM was 8% (2/25). Unexpectedly, the incidence of SM was not significantly different between the 2 groups ($p = 0.134$) (Table 4).

Table 4. Comparison of the incidence of SM according to the antibiotic treatment course.

	Number (n)	≤7 d (n)	>7 d (n)
Non-SM	262	23	239
SM	63	2	61
χ^2			2.246
P			0.134

Non-SM – non-suppurative mastitis.

Table 5. Comparison of the incidence of SM according to the diabetic status.

	Number (n)	Non-diabetics (n)	Diabetics (n)
Non-SM	262	247	15
SM	63	52	11
χ^2			9.503
P			0.002

Non-SM – non-suppurative mastitis.

Table 6. Comparison of the incidence of SM in patients with or without nipple injuries.

	Number (n)	Without nipple injuries (n)	With nipple injuries (n)
Non-SM	262	193	69
SM	63	21	42
χ^2			36.734
P			<0.0001

Non-SM – non-suppurative mastitis.

Comparison of the incidence of SM in relation to diabetes

The incidence of SM in diabetic patients was 42.31% (11/26), which was significantly higher than that in non-diabetic patients (17.39%; 52/299) ($p=0.002$) (Table 5).

Comparison of the incidence of SM in patients with or without nipple injuries

The incidence of SM was 37.84% (42/111) in patients with nipple injuries and 9.81% (21/214) in patients without nipple injuries (Table 6). There was a significant difference between the 2 groups ($p<0.0001$).

Safety evaluation

In this study, we found no cases with any drug allergies, rash, shock, vasculitis, or any other serious adverse events during the course of treatment.

Discussion

Acute mastitis occurs in lactating mothers, with acute onset. The breast appears red, swollen, hot, and painful, and sometimes a breast mass can be found in the early period [12]. If not controlled in a timely manner, the acute inflammation can deteriorate rapidly to an abscess in a few days. The abscess can be diagnosed by puncture and drainage [13].

Multiple studies have shown the decreased bacterial diversity in the microbiome of milk samples in patients with mastitis when compared with patients without mastitis. Various pathogens were found to be the key etiological agents in different types of mastitis [14,15]. In subacute mastitis, *Staphylococcus epidermidis* has been identified as the predominant etiological agent, whereas acute mastitis is usually caused by *Staphylococcus aureus* infection [16]. The bacteria not only invade the damaged or chapped nipples, but also invade into the mammary duct directly and spread to the mammary gland [17]. At the beginning of acute mastitis, the affected breast is painful, especially

when breastfeeding. Acute mastitis is sometimes associated with galactostasis, resulting from the blockage of 1 or 2 mammary ducts. In that situation, a breast mass forms, accompanied by systemic symptoms, including fever, headache, chills, poor appetite, and irritable mood [18,19]. If not treated in time, the mass will become soft and a dynamic move can be felt when pressing the mass, suggesting the formation of a breast abscess [20]. If the position of the breast abscess is deep, patients may develop high fever, pain, and swelling of the whole breast, and a puncture is required to confirm the diagnosis [13]. Abscesses can pierce the skin, or penetrate the breast milk ducts, causing pus to flow out from the nipple. When the pus breaks out, the drainage of pus is unobstructed, and the swelling is reduced and gradually healed. However, if the treatment is not timely or appropriate, sepsis may develop as a severe complication [21]. Acute mastitis is often associated with swollen and tender lymph nodes in the armpit of the affected side, with an increased number of leukocytes and neutrophils [22].

Acute mastitis of lactation can be generally divided into 2 types: non-SM and SM [23,24]. Non-SM can be treated by hot compresses on the breast, physical cooling, anti-inflammation medications, and other conservative approaches to promote the evacuation of breast milk. However, SM involves breast abscess, requiring surgical incision and drainage for treatment [25]. SM is more serious than simple mastitis, seriously affecting the health of the mothers and babies. A study of 946 breastfeeding women in the United States in 2002 showed that history of mastitis with a previous child, cracks and nipple sores in the same week as mastitis, use of an anti-fungal nipple cream for nipple thrush, use of a manual breast pump, and feeding more than 10 times per day strongly predicted mastitis [21]. In the present study, the risk factors for SM in the breastfeeding women were determined. We found that primipara was a high-risk factor for SM. The incidence of SM in primiparous patients was significantly higher than that in the pluriparous patients, possibly resulting from the lack of breastfeeding experience, inappropriate breastfeeding posture, or incorrect nursing approach of primipara women. In addition, the incidence of SM in patients with admission time greater than 72 h after the occurrence of acute mastitis

was significantly higher than that in patients with admission time less than 72 h after the occurrence. This finding suggested that admission time was a risk factor for SM, which may have been associated with the delayed treatment of the disease. As mentioned above, if breast milk discharge is not performed in a timely manner for mothers with acute mastitis, breast milk stasis and secondary bacterial infection after abscess formation will occur. In this study, the ratio of SM in patients with galactostasis was significantly higher than that in patients without galactostasis, indicating that breastfeeding women with galactostasis were more susceptible to SM. In addition, the incidence of SM in patients suffering from diabetes was significantly higher than that in non-diabetic patients, likely caused by disorders of blood glucose metabolism in diabetic patients and higher bacterial reproduction in high blood sugar environments. Further, the incidence of SM in patients with nipple injuries was significantly higher than that in patients without nipple injuries, which may be due to the bacteria-mediated direct invasion and thus infections of breast tissue through the injured nipple, suggesting that nipple injury is a high-risk factor for SM. Unexpectedly, no significant correlation was found between the incidence of SM and the course of antibiotic treatment, possibly because almost all patients with acute mastitis were treated with a full course of anti-infection drugs.

Conclusions

This retrospective study showed that the incidence of SM during lactation was closely associated with admission time after acute mastitis occurrence, galactostasis, primipara or pluripara, nipple injuries, and diabetic status, suggesting these are all high-risk factors for SM in patients during the breastfeeding period. However, due to the limited sample numbers enrolled in this study, a clinical study with a larger cohort is required to confirm our findings.

Conflict of Interest

None.

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