
OBSTETRICS

Incidence of Early Postpartum Mastitis with the Predisposing Factors, the Recovery Period After Care Management and the Exclusive Breastfeeding Outcomes

Pawin Puapornpong, M.D.*,
Aurasa Hemachandra, M.D.*,
Maysita Suksamarnwong, M.D.*,
Wipada Laosooksathit, M.D.*,
Tharangrut Hanprasertpong, M.D.*,
Nongyao Lawin**.

* *Department of Obstetrics and Gynecology, Faculty of Medicine, Srinakharinwirot University, Nakhon Nayok, Thailand*

** *Obstetric and Gynecology nursing department, HRH Princess Maha Chakri Sirindhorn Medical Center, Nakhon Nayok, Thailand*

ABSTRACT

Objectives: To investigate the incidence of early postpartum mastitis, the predisposing factors, the recovery period and the exclusive breastfeeding outcomes at the one month postpartum period.

Materials and Methods: Singleton, postpartum women without complications and had at least 6 months of breastfeeding intent were recruited. Demographic data and the predisposing factors, the number of mastitis incidences, the recovery periods and exclusive breastfeeding rates were recorded and followed-up during a one month period. If mastitis was diagnosed, mothers were advised to breastfeed frequently, apply hot compresses and to express milk. Antibiotics were only used in suspected infective mastitis. At the one-month follow-up, the breastfeeding data was collected from the subjects' breastfeeding record forms and analyzed.

Results: The data from 1,025 postpartum mothers were collected for analyses, 950 mothers without and 75 with mastitis. Non-infective and infective mastitis was found in 65.3% and 34.7% of all mastitis cases, respectively. Relative risks of mastitis for cesarean section deliveries, being overweight, delayed breastfeeding initiation of more than 6 hours and a previous history of mastitis were 2.0 (95% confidence interval (CI) = 1.3-3.2), 1.6 (95%CI = 1.2-2.3), 2.2 ((95%CI = 1.4-3.1), and 6.1 (95%CI = 2.1-18.0), respectively. Most mothers with mastitis had a one-week recovery period for non-infective (73.5%) and two-weeks of recovery for infective mastitis (69.2%). Relative risks of exclusive breastfeeding for mastitis was 0.5 (95%CI = 0.3-0.8).

Conclusion: The incidence of early postpartum mastitis was 7.3%. Factors associated with milk stasis resulting from the delayed initiation of breastfeeding may be one cause of mastitis in early postpartum. Therefore, supporting early breastfeeding initiation practice could prove beneficial in the prevention of mastitis and improve breastfeeding outcomes.

Keywords: mastitis, predisposing factor, recovery period, breastfeeding outcome

อุบัติการณ์ของเต้านมอักเสบในระยะแรกหลังคลอด ปัจจัยส่งเสริมการเกิดโรค ระยะเวลาการหายจากโรคหลังการดูแลรักษาและผลต่อการเลี้ยงลูกด้วยนมแม่อย่างเดี่ยว

ภาวิน พัวพรพงษ์, อรสา เหมะจันทร์, เมลิตา สุขสมานวงศ์, วิภาดา เลาสุขสถิตย์, ธารารัตน์ หาญประเสริฐพงษ์, นงเยาว์ ลาวินห์

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาอุบัติการณ์ของเต้านมอักเสบในระยะแรกหลังคลอด ปัจจัยส่งเสริมการเกิดโรค ระยะเวลาการหายจากโรค และผลต่อการเลี้ยงลูกด้วยนมแม่อย่างเดี่ยวในช่วงระยะเวลาหนึ่งเดือนหลังคลอด

วัสดุและวิธีการ: มารดาครรภ์เดี่ยวหลังคลอดที่ไม่มีภาวะแทรกซ้อนและมีความตั้งใจจะเลี้ยงลูกด้วยนมแม่น้อยหกเดือนจะได้รับการคัดเลือกเข้าสู่งานวิจัย ข้อมูลพื้นฐาน ปัจจัยส่งเสริมการเกิดโรค จำนวนอุบัติการณ์ของการเกิดเต้านมอักเสบ ระยะเวลาการหายจากโรค และข้อมูลการเลี้ยงลูกด้วยนมแม่อย่างเดี่ยวจะได้รับการบันทึกและติดตามเป็นระยะเวลาหนึ่งเดือนหลังคลอด หากมารดาได้รับการวินิจฉัยว่ามีเต้านมอักเสบ มารดาจะได้รับการแนะนำให้มีการให้นมลูกบ่อยๆ ประคบร้อนและมีการบีบหรือปั้มนม ยาปฏิชีวนะจะให้เฉพาะในรายที่สงสัยว่าเป็นเต้านมอักเสบที่มีการติดเชื้อ ติดตามข้อมูลการเลี้ยงลูกด้วยนมแม่อย่างเดี่ยวของมารดาหลังคลอดจากแบบบันทึกข้อมูลการเลี้ยงลูกด้วยนมแม่จนกระทั่งครบหนึ่งเดือน และนำมาวิเคราะห์ผล

ผลการศึกษา: ข้อมูลจากมารดาหลังคลอด 1,025 รายได้รับการรวบรวมสำหรับภาวะวิเคราะห์ผล พบมารดาที่ไม่มีเต้านมอักเสบจำนวน 950 ราย และพบมารดาที่มีเต้านมอักเสบจำนวน 75 ราย ในมารดาที่มีเต้านมอักเสบพบว่ามีเต้านมอักเสบที่ไม่มีติดเชื้อร้อยละ 65.3 และพบเต้านมอักเสบที่มีการติดเชื้อร้อยละ 34.7 ค่าความเสี่ยงสัมพัทธ์ของเต้านมอักเสบสำหรับการผ่าตัดคลอดเท่ากับ 2.0 (ช่วงค่าความเชื่อมั่นร้อยละ 95 เท่ากับ 1.3-3.2) ค่าความเสี่ยงสัมพัทธ์ของเต้านมอักเสบสำหรับการมีน้ำหนักเกินเท่ากับ 1.6 (ช่วงค่าความเชื่อมั่นร้อยละ 95 เท่ากับ 1.2-2.3) ค่าความเสี่ยงสัมพัทธ์ของเต้านมอักเสบสำหรับการเริ่มการให้นมลูกช้ากว่า 6 ชั่วโมง 2.2 (ช่วงค่าความเชื่อมั่นร้อยละ 95 เท่ากับ 2.1-18.0) มารดาที่มีเต้านมอักเสบส่วนใหญ่จะมีระยะการหายจากโรคภายในหนึ่งสัปดาห์หากมีเต้านมอักเสบที่ไม่มีการติดเชื้อ (ร้อยละ 73.5) และจะมีระยะการหายจากโรคภายในสองสัปดาห์หากมีเต้านมอักเสบที่มีการติดเชื้อ (ร้อยละ 69.2) ค่าความเสี่ยงสัมพัทธ์ของเต้านมอักเสบสำหรับการเลี้ยงลูกด้วยนมแม่อย่างเดี่ยวเท่ากับ 0.5 (ช่วงค่าความเชื่อมั่นร้อยละ 95 เท่ากับ 0.3-0.8)

สรุป: อุบัติการณ์เต้านมอักเสบในระยะแรกหลังคลอดร้อยละ 7.3 ปัจจัยที่สัมพันธ์กับการชั่งของน้ำหนักที่เป็นผลมาจากการเริ่มต้นการให้ลูกกินนมแม่ซ้ำอาจจะเป็นหนึ่งในสาเหตุที่สำคัญของการเกิดเต้านมอักเสบ ดังนั้น การสนับสนุนให้ทารกได้เริ่มนมแม่ตั้งแต่ในระยะแรกหลังคลอดน่าจะช่วยป้องกันการเกิดเต้านมอักเสบและช่วยให้ผลลัพธ์การเลี้ยงลูกด้วยนมแม่ดีขึ้น

คำสำคัญ: เต้านมอักเสบ, ปัจจัยส่งเสริมการเกิดโรค, ระยะเวลาการหายจากโรค, ผลลัพธ์ของการเลี้ยงลูกด้วยนมแม่

Introduction

Mastitis is localized, painful inflammation of the breast with concurrent flu-like symptoms⁽¹⁾. It is one of a new mother's serious complications during the breastfeeding period. This complication can affect breastfeeding duration if there is no appropriate intervention⁽²⁾. The incidence of mastitis varies widely with a range from 2.5% to 33.0 % due to different mastitis definitions, varying duration of postpartum case collections and differences in breastfeeding practices⁽¹⁻⁶⁾. However, mastitis commonly occurs in the first month postpartum with a higher incidence in the first few weeks postpartum⁽²⁾.

One cause of mastitis is inadequate milk removal from the breast leading to milk stasis⁽²⁻⁴⁾. The plausible factors associated with mastitis are the maternal age, education level, place of delivery, route of delivery, birth weight, time to initiation of breastfeeding, prelacteal feeding, previous history of mastitis with a sibling, inappropriate latching and positioning, cracked or sore nipples, blocked ducts, breast milk replenishment longer than 24 hours, child-mother separation longer than a 24 hour period, antibiotic use during breastfeeding and breast pumping^(2, 5, 7, 8).

Diagnostic criteria for mastitis are based on clinical signs and symptoms. There are two breast symptoms of pain, redness or lumps and at least one flu-like symptom that can include fever, shivering, chills and headache^(1, 2, 4, 8). The managements of mastitis are breastfeeding frequently or expressing milk from the affected breast to clear blocked ducts and reduce engorgement. Analgesics, hot compresses and antibiotics are used when necessary. Early diagnosis and proper management are necessary to prevent adverse breastfeeding outcomes. However, there were a few studies that explored the predisposing factors, management and breastfeeding outcomes following treatments for mastitis. We were interested in these concerns for mothers with early postpartum mastitis during the

first month including exclusive breastfeeding outcomes.

Materials and Methods

This study was performed in the Nakhon Nayok province, a rural area in the central part of Thailand. The data was collected during the period from January, 2016 to December, 2017 at the HRH Princess Maha Chakri Sririndhorn Medical Center. This is known as a baby friendly hospital. A routine practice in the postpartum ward is breastfeeding education. The one-hour course in breastfeeding, that includes latching, is taught on the first day postpartum. One nurse teaches a group of 3-5 mothers. Mothers are encouraged to stimulate their infants to feed 8-12 times per day. Mothers and babies are discharged at the second day postpartum if there are no complications. Mothers' and babies' follow-up at the breastfeeding clinic are routinely set at one week and one month postpartum.

This study was a prospective cohort study. Singleton, postpartum mothers who delivered term infants without complications and had at least 6 months of breastfeeding intent were recruited for this study. Demographic data and factors reported to have effects on mastitis and exclusive breastfeeding rates were recorded. Nurses gave a mastitis record form to mothers and advised them to daily record in the mastitis form when they experienced pain, redness or lumps of the breast during their stay in the postpartum ward and at home following discharge. Mastitis is diagnosed when mothers have two breast symptoms of pain, redness or lumps and at least one of the flu-like symptoms that include fever, shivering or chills and headache. Mothers who had complete criteria for a diagnosis of mastitis were advised to contact the breastfeeding clinic and come in for care management. Breastfeeding clinic follow-ups were routinely set at one week and one month. At the breastfeeding clinic, the mastitis record form was collected and the history, physical examination and breastfeeding observations were evaluated by a

physician in the mothers who had a diagnosis of mastitis. Bacterial cultures were only used if complicated, infective mastitis cases were suspected, if there was no response to antibiotics after two days of medication or if it was hospital acquired mastitis⁽⁶⁾. Mothers with mastitis were advised to breastfeed frequently (at 8-12 times per day). Hot compresses and expressing milk by a breast pump were treatments given to mothers at the breastfeeding clinic and acetaminophen was prescribed to mothers as a home medication. Antibiotics were only used for suspected infective mastitis. The mothers who had a prolonged fever for more than 24 hours or had cracked nipples were included in this category. Cloxacillin was used as the first line drug for 7-14 days or cephalexin for mothers who had a prior history of an allergic reaction to penicillin. The mastitis data was divided into two subgroups for analysis, non-infective and infective mastitis. The mastitis cases were followed up every 3-7 days until the problem resolved. At the one-month follow-up, the breastfeeding data was collected from the breastfeeding record forms and analyzed.

Mastitis was defined as having two breast symptoms of pain, redness or lumps and at least one flu-like symptom that included fever, shivering, chills and headache^(1, 2, 4, 8).

Infectious mastitis was defined as meeting mastitis criteria with having prolonged fever for more than 24 hours or having cracked nipples^(2, 9). Non-infective mastitis was defined as having only complete mastitis criteria.

The mastitis record form consists of two parts. Part one is the mastitis diagnostic checklist. If mothers had complete criteria for a diagnosis of mastitis, a breastfeeding clinic contact was advised. Part two is the predisposing factor checklist that includes a history of mastitis with a previous child, cracked or sore nipples, blocked ducts, child-mother separation of longer than 24 hours, antibiotic use during breastfeeding and breast pumping. Mothers recorded blocked ducts

complication if they had complete checklists of breast lumps with or without pain after persisting a feed in item 1 or had item 1 with redness and firmness at involved area in item 2. Mothers who had checklists for a diagnosis of blocked ducts were advised to contact the breastfeeding clinic for care management if blocked ducts persisted more than 2 days. Mothers were advised to daily record on the mastitis record form during one month postpartum period.

Exclusive breastfeeding is defined as no other food or drink (including water) other than breast milk. This includes expressed milk. The infant can receive drops and syrups of vitamins, minerals, medicine and other oral rehydration salts (ORS). The exclusive breastfeeding rate data at one month postpartum were collected in the breastfeeding record form in the breastfeeding notebook. Mothers were taught to record, daily, all breastfeeds and any fluids or foods given to their infant in the breastfeeding notebook that was given to the mother prior to discharge. Exclusive breastfeeding results were collected from the mother consistently with the established definitions.

Prior to treatment, two small towels were prepared and steamed in a stacked steamer pot for twenty minutes. Then, the first towel ball was wrapped with a towel to protect the mothers' skin from burns due to excessive heat. The nurse gently touched and rolled the towel ball on the breast areas with the exception of the nipple and areola. The contact time for each point was approximately ten seconds. The towel was unwrapped when the towel ball was warm enough to put directly on mother's skin. The towel ball was replaced when the first was detected to be lukewarm. The two towel balls were alternately compressed and alternately streamed until the full treatment session time was achieved. The total session duration was twenty minutes. After hot compresses, expressing milk was done by an electric pump. The pumping duration was twenty minutes. Hot compresses and expressing milk by a breast pump were treatments

given to mothers at the breastfeeding clinic once a day until the symptoms disappeared.

Postpartum women who had deliveries without complications (i.e. multiple pregnancies, preeclampsia, antepartum hemorrhaging and preterm labor) and had at least 6 months of breastfeeding intent were recruited for this study. Their infants had birth weights of more than 2,500 grams and were born without complications. The mothers had not suffered from acute postpartum hemorrhages and had no contraindications to breastfeeding. Mothers whose infants were diagnosed with galactosemia and mothers who could not complete record forms were excluded from this study.

Sample size calculated by objective determining the incidence of mastitis was 340 cases (33% from previous study). Sample size in present study had 1,025 cases which was enough to analysis. But another event that we interest was breastfeeding outcomes between infective and non-infective mastitis cases. We set a value of 1.5 as a relative risk of the exclusive breastfeeding outcomes between infective and non-infective mastitis from a pilot study done in 20 cases. We used 0.05 of α error, a power of 0.95 and an effect size = 0.58. The calculated sample size numbered 60 cases. The subjects were totaled with an additional 25% for data loss. The total samples collected were 75 cases. We needed 60 cases with mastitis at least in present study.

This study was approved by The Ethics Committee of the Srinakharinwirot University.

Demographic data was reported in means and percentages. We used the t-test to compare the mean of maternal ages, income, body mass index (BMI) and time of breastfeeding initiation between both groups. The data regarding marital status, education, occupation, route of delivery, breastfeeding experience and history of previous mastitis were analyzed by chi-square. A p value less than 0.05 considered statistically significant. Statistical analysis was performed using SPSS

software (version 23.0, SPSS, Inc.).

Results

Postpartum women that had enrolled in our research project totaled 1,059 cases. There were 1,025 complete record forms (96.8%) for analysis. There were 75 mothers (7.3%) with a diagnosis of the mastitis during one-month period; 52 cases (69.3%) in the first week, 22 cases (29.3%) in the second week and 1 case (1.3%) in the third week. The number of non-infective mastitis cases totaled 49 (65.3%) and the number of infective cases at 26 (34.7%). The non-infective mastitis cases were 39 in the first week (75.0%) and 10 in the second week (45.5%). The infective mastitis cases were 13 in the first week (25%), 12 in the second week (54.5%) and 1 in the third week (100%). There were three infectious mastitis cases (11.5%) suspected as complicated infectious mastitis cases from no response to antibiotics after two days of medication. However, it did not look like hospital acquired infection because all bacterial culture results showed numerous *Staphylococcus Aureus* sensitive to cloxacillin. A flow chart of the number of participants is shown in figure 1. The details of demographic data and predisposing factors are shown in Table 1.

After demographic data and predisposing factors were analyzed, significant variables were categorized for relative risk analysis; delivery route into cesarean and vaginal deliveries, BMI into overweight & obesity (BMI \geq 25) and underweight & normal weight (BMI < 25), time to initiate breastfeeding into delayed initiation of breastfeeding (time to initiate breastfeeding \geq 6 hours) and non-delayed initiation of breastfeeding (time to initiate breastfeeding < 6 hours), history of previous mastitis into having history of previous mastitis and no history of previous mastitis. There were statistically significant differences in the delivery route, BMI, time to initiate breastfeeding and previous history of mastitis between mothers with and without mastitis. The details of relative risks of mastitis are shown in Table 2.

Table 1. Demographic data of mothers and predisposing factors.

Mothers' data	No mastitis group (n = 950)	Mastitis group (n = 75)	p value
Age (years)	26.8 ± 5.4	27.0 ± 5.3	0.74
Marital status, n (%)			
Married	912 (96.0)	71 (94.7)	0.85
Single	38 (4.0)	4 (5.3)	
Education, n (%)			
high school and lower	655 (68.9)	47 (62.7)	0.17
bachelor's degree	295 (31.1)	28 (37.3)	
Income (baht/month)	20,336.4 ± 24,836.5	21,539.5 ± 19,698.6	0.56
Occupation, n (%)			
Housewife or self-employed	418 (44.0)	35 (46.7)	0.58
Employee	532 (56.0)	40 (53.3)	
Route of delivery, n (%)			
vaginal delivery	570 (60.0)	32 (42.7)	< 0.01
Cesarean section	380 (40.0)	43 (57.3)	
BMI (kg/m ²)	23.3 ± 5.6	26.2 ± 4.7	< 0.01
Breastfeeding experience, n (%)			
Yes	494 (52.0)	37 (49.3)	0.32
No	456 (48.0)	38 (50.7)	
Time of breastfeeding initiation (hour postpartum)	2.5 ± 2.7	6.7 ± 2.3	< 0.01
History of previous mastitis	11 (1.16)	5 (6.67)	< 0.01

The data of age, income, BMI (body mass index) and time to breastfeeding initiation were presented as mean ± standard deviation.

Table 2. Relative risks of mastitis.

Variables	Relative risk	95%CI
Cesarean section	2.0	1.3-3.2
Overweight & obesity	1.6	1.2-2.3
Delayed initiation of breastfeeding	2.2	1.4-3.1
History of previous mastitis	6.1	2.1-18.0

BMI: body mass index, 95%CI: 95% confidence interval.

Delayed initiation of breastfeeding = time to breastfeeding initiation more than 6 hours

At one month postpartum, the data of the exclusive breastfeeding rates were collected among mothers with mastitis. There were 25 cases that were lost to follow-up among the mothers without mastitis. The completed follow-ups were at 97.6%. The comparison of exclusive breastfeeding rates between mothers with and without mastitis at one month

postpartum are shown that 33 cases (44.0%) of mothers with mastitis had exclusive breastfeeding and 556 cases (60.1%) of mothers without mastitis had exclusive breastfeeding. There was statistically significant difference of exclusive breastfeeding rate between mothers with and without mastitis. ($p < 0.01$) Relative risk was 0.52. (95%CI 0.32-0.84).

The percentage of non-infective and infective mastitis, recovery period and exclusive breastfeeding rates at one month are shown in Table 3. There were 36 (73.5%) and 13 cases (26.5%) that had a one-week and a two-week recovery period among the non-infective mastitis group, respectively. There were 18 cases (69.2%), 7 cases (26.9%) and 1 case (3.9%) that had a two-week, three-week and four-week recovery period among the infective mastitis group, respectively. There was a single case that had a

prolonged recovery period of four weeks and this patient was investigated with bacterial cultures at post-treatment day 3. The results showed numerous *Staphylococcus Aureus* sensitive to cloxacillin, and by ultrasound at one week after commencing the antibiotic treatment a breast abscess was found with necessary repeated aspirations in the treatment. There were no statistically significant differences of the exclusive breastfeeding rates between the non-infective and infective mastitis groups ($p = 0.23$).

Table 3. The percentage of non-infective and infective mastitis, recovery period and exclusive breastfeeding at one month.

Mastitis type	No. of cases	Percentage	Recovery period (weeks)	Mean of recovery period (weeks)	Exclusive breastfeeding rate at one month, n%
Non-infective mastitis	49	65.3	1 - 2	1.3	24 (49.0)
Infective mastitis	26	34.7	2 - 4	2.3	9 (34.6)

Discussion

The incidence of mastitis was 7.3% during the one-month period and 98.7% of the cases occurred within the first two weeks. This result was similar to those seen in the study of Khanal et al⁽²⁾. The predisposing factors of mastitis were cesarean section deliveries, being overweight and obesity, delayed initiation of breastfeeding and a previous history of mastitis. Mothers with cesarean section deliveries had more pain that interfered with their ability to hold, breastfeed and care for their baby. As a result, they had a greater risk of delayed breastfeeding initiation⁽¹⁰⁻¹²⁾. Being overweight and obesity was another factor that delayed the initiation of breastfeeding^(13, 14). A previous history of mastitis might indicate some repeated predisposing factors. We believed that having factors associated with milk stasis from delayed breastfeeding initiation might be the cause of mastitis in the early postpartum period. The predisposing factors of mastitis included cesarean section deliveries, delayed initiation of breastfeeding and a history of previous mastitis were consistent with a previous study with the exception of

being overweight and obesity⁽²⁾. The association between being overweight and obesity or other factors delaying the initiation of breastfeeding and the incidence of mastitis should be investigated in further studies. However, supporting early breastfeeding initiation practices might be beneficial to prevent mastitis or improve breastfeeding outcomes.

The exclusive breastfeeding rates of mothers with mastitis were significantly lower than the exclusive breastfeeding rates of mothers without. This result was different from previous studies^(1, 2). It might be due to different definitions of the breastfeeding outcomes and the point that assesses the duration of breastfeeding. Exclusive breastfeeding was the breastfeeding outcome for this study but "Only breastfeeding" was the outcome from the study of Amir et al⁽¹⁾. Exclusive breastfeeding was assessed at the first month in this study and at the fourth and sixth months in the study of Khanal et al⁽²⁾. We believe that mastitis or its treatments may increase infant formula use and temporarily stopping exclusive breastfeeding as the concern of developing mastitis or the drugs of treatment would have adverse effects on

the infants. However, reasons for stopping exclusive breastfeeding among mothers with mastitis were not a part of the investigation in this study.

Most mothers with mastitis had one-week recovery periods for non-infective and two-week recovery for infective cases. Therefore, mothers who infective mastitis were suspected would receive data for longer periods of follow-up, antibiotic use and the need for milk removal by continuous breastfeeding. This would prompt mothers for good compliance which can affect treatment outcomes and prevent serious complications of breast abscesses. We found that one case with mastitis had a complication of a breast abscess. This mother had a large area of redness and a palpable lump at her left breast (about 7 centimeters in diameter) at the first hospital arrival. She was diagnosed for mastitis and received treatment following the preconceived guidelines. After 3 days of treatment, she had no clinical improvement. She was investigated by ultrasound and diagnosed for breast abscess. Ultrasound showed heterogenous collection which measured 5.0x4.3x2.0 centimeters. Aspiration with an 18-gauge needle was used for treatment and its' content had 20 milliliters of thick yellowish material which was sent for bacterial culture. Culture showed growth of *Staphylococcus aureus* sensitive to cloxacillin. This mother needed repeat needle aspiration which had 10 milliliters of content in the next 2 days. After that, she got cloxacillin and ultrasound follow-up until no sign of inflammation and infection. Total duration of treatment was 4 weeks.

The strength of this study was that it was a cohort study. The definition of mastitis and the methods of treatment have been defined. The breastfeeding outcomes were collected by a daily breastfeeding record form which helped to reduce recall bias. There were high percentages of mothers with a one-month follow-up (97.6%). However, this study had limitation: the confounding variables (cesarean delivery, BMI, delayed breastfeeding initiation and history of previous mastitis) were not controlled and time to follow-up was limited only the 1st 4 weeks postpartum. Furthermore, the reasons for stopping exclusive breastfeeding among

mothers with mastitis in this study were not investigated. Further studies may help to answer this question.

Conclusion

The incidence of mastitis was 7.3% at one month postpartum. Non-infective and infective mastitis was found in 65.3% and 34.7% of all mastitis cases, respectively. The predisposing factors for mastitis were cesarean section deliveries, being overweight and obesity, delayed initiation of breastfeeding and previous history of mastitis. Most mothers with mastitis had one-week recovery for non-infective and two-weeks of recovery for infective mastitis. The exclusive breastfeeding rates in mothers with mastitis were lower than the rates of mothers without mastitis. There were no significant differences of the exclusive breastfeeding rates between non-infective and infective mastitis groups.

Acknowledgements

The authors thank to the HRH Princess Maha Chakri Sririndhorn Medical Center and the Faculty of Medicine, Srinakharinwirot University for supporting our research.

Potential conflicts of interest

The authors declare no conflict of interest.

References

1. Amir LH, Forster DA, Lumley J, McLachlan H. A descriptive study of mastitis in Australian breastfeeding women: incidence and determinants. *BMC Public Health* 2007;7:62.
2. Khanal V, Scott JA, Lee AH, Binns CW. Incidence of mastitis in the neonatal period in a traditional breastfeeding society: results of a cohort study. *Breastfeed Med* 2015;10:481-7.
3. Foxman B, Schwartz K, Looman SJ. Breastfeeding practices and lactation mastitis. *Soc Sci Med* 1994;38:755-61.
4. Spencer JP. Management of mastitis in breastfeeding women. *Am Fam Physician* 2008;78:727-31.
5. Kvist LJ. Re-examination of old truths: replication of a study to measure the incidence of lactational mastitis in breastfeeding women. *Int Breastfeed J* 2013;8:2.

6. Amir LH. ABM clinical protocol #4: Mastitis, revised March 2014. *Breastfeed Med* 2014;9:239-43.
7. Mediano P, Fernandez L, Rodriguez JM, Marin M. Case-control study of risk factors for infectious mastitis in Spanish breastfeeding women. *BMC Pregnancy Childbirth* 2014;14:195.
8. Kinlay JR, O'Connell DL, Kinlay S. Risk factors for mastitis in breastfeeding women: results of a prospective cohort study. *Aust N Z J Public Health* 2001;25:115-20.
9. Amir LH, Academy of Breastfeeding Medicine Protocol C. ABM clinical protocol #4: Mastitis, revised March 2014. *Breastfeed Med* 2014;9:239-43.
10. Albokhary AA, James JP. Does cesarean section have an impact on the successful initiation of breastfeeding in Saudi Arabia? *Saudi Med J* 2014;35:1400-3.
11. Wallenborn JT, Graves WC, Masho SW. Breastfeeding initiation in mothers with repeat cesarean section: the impact of marital status. *Breastfeed Med* 2017;12:227-32.
12. Azzeh FS, Alazzeah AY, Hijazi HH, Wazzan HY, Jawharji MT, Jazar AS, et al. Factors associated with not breastfeeding and delaying the early initiation of breastfeeding in Mecca region, Saudi Arabia. *Children (Basel)* 2018;5:8.
13. Donath SM, Amir LH. Maternal obesity and initiation and duration of breastfeeding: data from the longitudinal study of Australian children. *Matern Child Nutr* 2008;4:163-70.
14. Mehta UJ, Siega-Riz AM, Herring AH, Adair LS, Bentley ME. Maternal obesity, psychological factors, and breastfeeding initiation. *Breastfeed Med* 2011;6:369-76.