Research article

Single-catheter minimally invasive method of interventional continuous vacuum drainage for the treatment of lactational purulent mastitis

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(Received: February 2023 Revised: April 2023 Accepted: May 2023)

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ABSTRACT

Introduction and Aim: Breast infections are an increasing problem for women who are breastfeeding, with symptoms ranging from mastitis to the development of abscesses. The aim of this study is to develop a minimally invasive method of interventional continuous vacuum drainage for the treatment of lactational purulent mastitis.

Materials and Methods: All 53 patients were comparable based on the duration of the disease prior to surgery and the timing of the emergence of mastitis after delivery, as well as the location and prevalence of the inflammatory process in the mammary gland.

Results: During the single-catheter method of vacuum drainage for the treatment of lactational purulent mastitis, lactation of the patient's affected breast was good in 2 (4.2%) patients and satisfactory in 46 (95.8%) patients. 38 (792%) women had good lactation, whereas 10 (21.8%) women had adequate lactation. After using the single-catheter method of vacuum drainage to treat lactational purulent mastitis, good lactation was seen in 40 (83.3%) instances, and it was satisfactory in 8 (16.7%) of patients.

Conclusion: A single-catheter interventional continuous vacuum drainage under ultrasound control was developed to treat lactational purulent mastitis without antibacterial therapy in 5–7 days, preserving lactation and achieving good aesthetic results.

Keywords: Lactational purulent mastitis; Single-catheter interventional continuous vacuum drainage; Mammary gland; Breastfeeding; Postoperative day.

INTRODUCTION

Breast infections are an increasing problem for women who are breastfeeding, with symptoms ranging from mastitis to the development of abscesses. It is difficult to emphasize the importance of lactational mastitis, one of the most prevalent postpartum issues, given both its high occurrence (up to 10%) in laboring women and its role in premature termination of breastfeeding (1).

Lactational mastitis can occur with purulent-inflammatory postpartum consequences in a range of 26–67% of cases. Most instances of lactational mastitis have a positive result; however, a lactational abscess only develops in 7–11% of clinical observations.

Cracked nipples, soft tissue injury to the mammary gland, abrupt cessation of breastfeeding, postpartum difficulties, first delivery, and comorbidities are risk factors for lactational mastitis. Wide incisions have been made, and breastfeeding has been surgically terminated in order to treat patients with lactational abscesses thus far. Breast incisions are accompanied by a prolonged healing process, the requirement for frequent dressings, discomfort, challenges with breastfeeding, and dissatisfying aesthetic results (2).

Staphylococcus aureus, which was detected in nine out of ten instances of mastitis, was shown to be very sensitive to semi-synthetic penicillins, lincomycin, and aminoglycosides and insensitive to sulfonamides, macrolides, and tetracyclines in studies on the susceptibility of mastitis pathogens to antibacterial agents. With the exception of carbenicillin and gentamicin, Proteus strains and other gram-negative bacteria were resistant to the majority of antibiotics. Based on these results, it was advised to treat serous and infiltrative mastitis with semisynthetic penicillins (ampicillin and oxacillin) (3, 4).

The primary form of treatment for lactational mastitis is antimicrobials. They should be given immediately as a diagnosis is made since this greatly influences the success of treatment and stops the growth of purulent processes. The complex therapy for postpartum mastitis also involves physical therapies, immune-modulating medications, infusion media, analgesics, and anti-inflammatory drugs (4, 5).

In addition to outpatient monitoring by medical specialists (surgeon, mammologist, ultrasound doctor),

effective emptying of the breast, prescription and nonsteroidal anti-inflammatory drugs, and maintaining breastfeeding, the current trend in the treatment of lactational breast abscess includes (6, 7). The aim of this study is to develop a minimally invasive method of interventional continuous vacuum drainage for the treatment of lactational purulent mastitis.

MATERIALS AND METHODS

From 2016 to 2021, 53 patients received treatment in the clinical facilities of the Moscow Medical University, Salymbekov University, Kyrgyzstan. All patients were comparable based on the duration of the disease prior to surgery and the timing of the emergence of mastitis after delivery, as well as the location and prevalence of the inflammatory process in the mammary gland.

Two abscesses in the mammary gland, no antibacterial medication administered before treatment, an abscess present for up to three days, an abscess smaller than 5 cm in diameter, and the lack of an infiltration shaft were all indications for this form of treatment. The diagnosis was confirmed using the following methods: anamnesis, complaints, clinical picture, ultra-sonography, and radio thermometry data, along with pus during abscess puncture.

Prior to illness, during mastitis (before surgery), and after hospital discharge, we assessed the lactation of both mammary glands. The gland was seen to be functioning well if it produced enough milk for an infant to consume normally and naturally. We considered lactation successful if additional feedings were necessary for the child's appropriate growth as a result of inadequate milk.

The technique is based on single-catheter interventional continuous vacuum drainage and the generation of negative pressure following the removal of purulent contents and decontamination of the abscess cavity. The processes of alteration, which are promoted by lymphostasis and a regular violation of microcirculation, are slowed down by negative pressure because it helps the cavity's walls adhere. The quick restoration of compromised microcirculation processes in surrounding cavities is facilitated by the artificial lowering of the region of inflammation caused by the development of negative pressure in the cavity. Aseptic inflammation, exudate transfusion, alteration of the underlying tissues, strengthening of the systemic inflammatory response syndrome, and the emergence of new abscesses are all caused by mechanical compression of the acinuses, which is manifested by an increase in general intoxication and a change in the leuko formula.

The following is the suggested course of therapy for lactational purulent mastitis:

1. In situations of pain hypersensitivity, manipulations are often done in stationary settings on an outpatient basis. Any ultrasound scanner with sensors that have a frequency over 5 MHz is used to see the abscessing cavities of mastitis and manage manipulations.
2. A peripheral soft Teflon catheter with an internal diameter of 0.6–2.2 mm and a length of up to 7–10 cm is worn on its own mandrel needle for manipulations. The optimum range for the catheter's internal diameter is between 1.2–1.6 mm in order to remove debris as effectively as possible and avoid having bigger debris particles impede the catheter lumen.

When debris is pumped out with a syringe, a small side hole is cut out at the end of the catheter to avoid an end suction effect.

1. Following the application of 96% ethyl alcohol to the skin or other antiseptics used in surgery, local anesthesia is applied to purulent foci using the standard procedure, using a 0.5% solution of novocaine or other local anesthetics in a quantity of 2–3 ml. With the help of an anesthesiologist, one can provide general intravenous anesthesia if necessary.
2. Using an ultrasonography catheter that is attached to the skin with a band-aid, each chamber of the abscess is penetrated into its lower pole after anesthesia. Purulent contents, necrotic masses, and tissue debris are evacuated following puncture of the abscess cavity and removal of the mandrel needle. Next, the abscess cavity is actively washed with antiseptic solutions (furacilin 1:5000) using a syringe until the washing liquid reaches the desired transparency. In parallel, the abscess cavity shrinks by 20–30% (Fig. 1 and 2).
3. Fig. 1 shows a plan for lactational purulent mastitis that is being treated with single-catheter interventional continuous vacuum drainage.

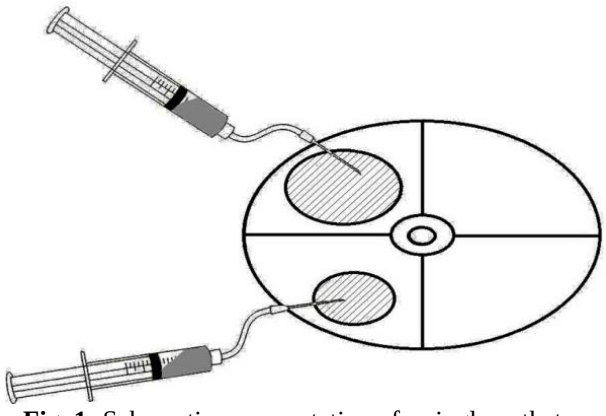

Fig. 1: Schematic representation of a single-catheter interventional continuous vacuum drainage of lactational purulent mastitis

4. An antibiotic solution, such as dioxidine, is injected into each cavity of the abscess until the patient experiences discomfort and a free flow of dioxidine from the cavity through a catheter.
5. Through the use of a rubber stopper that limits the catheter for three hours, the following goals were

attained: the maximal concentration of dioxidine in the cavity; enough bactericidal and bacteriostatic medication exposure; and necrotic tissue lysis.

6. The plug is opened three hours later, and a disposable blood transfusion system is attached to the catheter. This is done to use a medical pear (or syringe), which acts as a reservoir for the cavity's contents, to produce negative pressure in the system. The period of therapy is shortened because of the negative pressure produced, which accelerates the drainage of exudate from the cavity and the rapid decrease of the abscess cavity (Figs. 1 and 2).
7. Similar treatments are carried out 1–2 times each day for 3-5 days while being followed by ultrasonography, until exudation stops and the cavity is reduced to d = 0.3- 0.5 cm. The catheters are then withdrawn, and the puncture site is cleaned with a disinfectant solution.
8. This technique of therapy is unusual in that antibiotics are not used. Due to the antiseptic solution's quick passage through the abscess cavity, the antiseptic substance's absorption into the blood and mother's milk, as well as its subsequent impact on the child, are extremely rare or nonexistent.

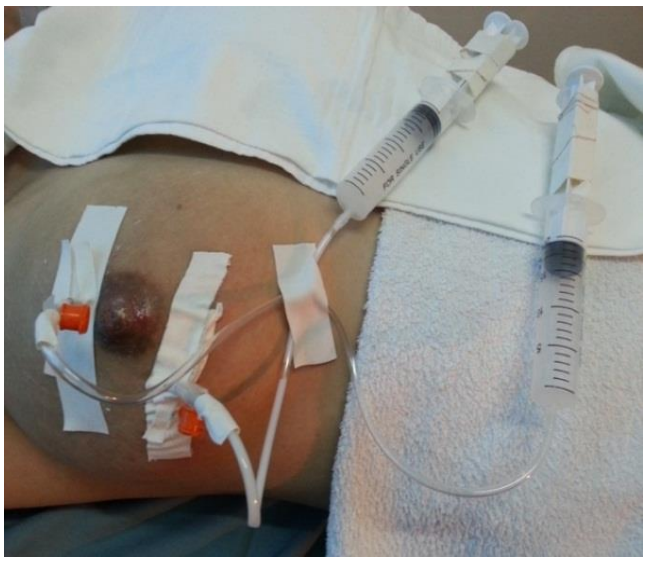

Fig. 2: The method of single-catheter interventional continuous vacuum drainage of lactational purulent mastitis

An GE Logiq P5 Ultrasound Machine (Los Angeles, United States) with a sensor with a frequency of 7.5 MHz was utilized to see the abscessing cavities of mastitis and monitor operations. A peripheral soft Teflon catheter with an internal diameter of over 2.5 mm and a length of 7–10 cm was worn on its own mandrel needle for manipulations. The number of cavities determined the number of catheters used.

The study's findings were statistically processed on MS Excel 2016 spreadsheets using relative indicators, averages, and the student's reliability criterion, as well as the Statistica 10 software program from StatSoft, Inc. (Los Angeles, United States) to calculate logistic regression analysis. The I.K. Akhunbaev Kyrgyz State Medical Academy Bioethics Committee approved the study (Protocol No. 9, dated February 17, 2016) and maintained the confidentiality of the collected data.

RESULTS

The overall health and well-being of patients considerably improve during the single-catheter approach of treating lactational purulent mastitis with vacuum drainage in the postoperative phase for one day, and discomfort in the mammary gland decreases. All patients' body temperatures returned to normal the second day following surgery. On the first day following surgery, local signs of the inflammatory process began to subside. For 2-3 days, the skin's hyperemia subsided. On the fourth day, the breast tissue's swelling stopped. Moderate infiltration persisted for up to seven days.

Cytological study of purulent materials determined from leukocytes (45–55–60) in the apparent sexes. The discharge from the cavities in the first two days following surgery is serous-purulent and contains 15–20 ml of fibrin films and necrotic tissue debris. The difference in white blood cell counts between the sexes is about 20–25–30. The chambers of the abscess were shrunk to 15–20 mm (Table 3).

The discharge started to become serious on the third day and was 3–5 ml in volume. The divided 5–10–15 abscess cavities' leukocyte counts fell to 5–10 mm. Separate serous in an amount up to 1 ml on the fifth day. the quantity of leukocytes in the visible floors of the cavity of abscesses up to 3 mm in size, divided 1–3–5 (Table 1).

In no case were there any complications in the form of illness progression or recurrence. In the single-catheter method of treating lactational purulent mastitis with vacuum drainage, we did not see the development of a lactic fistula.

The continued use of the mammary glands' ability to produce milk is one advantage associated with this method. Prior to the illness, during mastitis (before surgery), and 14 days following therapy, lactation was assessed. 42 (87.5%) of the women had good breastfeeding in the affected breast before the illness, and 4 (12.5%) had adequate lactation. 41 (85.4%) women reported that their pre-disease lactation was good, and 7 (14.6%) reported that it was satisfactory.

Table 1: Clinical and laboratory markers in the dynamics of the postoperative period with the single-catheter method of vacuum drainage of lactational purulent mastitis

Clinical and laboratory markers	Postoperative dynamics on day						
	1	2	3	4	5	6	7
Fever	+	-	-	-	-	-	-
Pain	+	-	-	-	-	-	-
Hyperemia	+	+	-	-	-	-	-
Swelling	+	+	+	+	-	-	-
Leukocytosis (10^9/L)	12–15	+	7–9	+	4–7	-	4–7
ESR (mm/hr)	25–30	+	15–20	+	10–15	+	10–15
Amount of discharge (ml)	20–30	10–15	3–5	1–3	1	-	-
Character of discharge	purulent	serous-purulent	serous	serous	serous	-	-
Cavity size (mm)	30–40	15–20	5–10	3–5	3	3	-
Infiltrate	+	+	+	+	+	+	+
The discharge's cytogram	45–55–60	20–25–30	5–10–15	3-5-10	1–3–5	-	-

Table 2: Lactation of the mammary glands in the dynamics of treatment of lactational purulent mastitis by the single-catheter method of vacuum drainage

Lactation of the mammary glands	Before the disease (after childbirth)	Lactational purulent mastitis (during treatment)	After treatment in 14 days
Lactation of the affected breast good satisfactory	 42 (87.5%) 4 (12.5%)	 2 (4.2%) 46 (95.8%)	 40 (83.3%) 8 (16.7%)
Lactation of a healthy breast good satisfactory	 41(85.4%) 7 (14.6%)	 38 (79.2%) 10 (21.8%)	 41 (85.4%) 7 (14.6%)

During the course of the single-catheter method of vacuum drainage for the treatment of lactational purulent mastitis, lactation of the patient's affected breast was good in 2 (4.2%) patients and satisfactory in 46 (95.8%) patients. 38 (792%) women had good lactation, whereas 10 (21.8%) women had adequate lactation. After using the single-catheter method of vacuum drainage to treat lactational purulent mastitis, good lactation was seen in 40 (83.3%) instances, and it was satisfactory in 8 (16.7%) of patients. In 41 (85.4%) cases, a healthy breast functioned well, and in 7 (14.6%) cases, it did so well (Table 2).

The single-catheter method of vacuum drainage for treating lactational purulent mastitis had positive cosmetic effects. Spot scars from catheter punctures up to 3 mm in size were no longer apparent after one month.

DISCUSSION

Mastitis is frequently incorrectly identified as a cancer or tuberculosis (8). A minimally invasive puncture or drainage of the abscess under ultrasound guidance is a choice for treating lactational purulent mastitis with abscess development (mostly for abscesses of small size, up to 6 cm; 6, 7).

Currently, the incidence of lactational purulent mastitis is 40-60% of all inflammatory diseases in the postpartum period in women, which is associated with an increase in the frequency of generalization of infection and the development of purulent-septic complications (9–15). Significantly improving the results of treatment will allow the search for new methods of treatment of lactational purulent mastitis, allowing to minimize breast injury during surgical treatment, to preserve lactation and aesthetics of the breast (16).

Gentamicin, whose effectiveness was 97.5% (17), is recommended in cases of severe purulent mastitis as well as re-infection of the wound in the postoperative period, taking into account the characteristics of the microflora (association of pathogenic Staphylococcus aureus with gram-positive microorganisms). In a more recent study of 664 cases of purulent mastitis, Staphylococcus aureus was found in purulent breast foci in 90.4% of cases. The microflora was resistant to penicillin and tetracycline, but most cultures were able to kill it with lincomycin and aminoglycosides (18).

Most situations involving the development of mastitis may be managed without the need for antibiotics by vigorously emptying the mammary glands and removing milk stasis. At the same time, the traditional recommendations of intensive and prolonged breast pumping as well as lactation do not produce the desired results because they cause the woman severe discomfort and often make the situation worse. Significant mastitis typically develops on the third or fourth day after delivery and is typically not caused by breastfeeding. Other treatments, including oxytocin injections, physical therapy, acupuncture, massage, and a variety of compresses, are similarly ineffective (19). The two-stage therapy for severe lactostasis was successful and well tolerated by female patients.

Implementing the first step, which aims to get rid of the mammary gland's hormonal imbalance, considerably lessens the phenomenon of lactostasis and makes it possible to breastfeed. Transdermal progesterone gel is the most efficient way to treat the initial stage of lactostasis. Most women have a significant reduction in mammary gland edema, engorgement, and discomfort with a single application of the gel, allowing them to begin lactation in 15–20 minutes and resume breastfeeding in one hour (20).

Mastitis should be treated as soon as the first symptoms show up in order to stop the condition from progressing to severe, purulent forms that necessitate surgery and cause major breastfeeding issues. All international guidelines, however, are based on the idea of effective milk removal, recommending for more frequent breastfeeding and higher compressions of the breast after breastfeeding. Applying warm compresses to the breasts prior to feeding and cool ones afterward, using analgesics (ibuprofen, paracetamol), consuming plenty of fluids, and getting enough rest in between feedings are all advised for pain alleviation. This strategy works in the majority of patients; the chronic and inflammatory symptoms in the mammary gland disappear and the women's health becomes better.

CONCLUSION

For the treatment of lactational purulent mastitis, a method of single-catheter interventional continuous vacuum drainage under the control of ultrasound was developed, in which, without the use of antibacterial therapy, complete recovery occurred within 5–7 days, with the preservation of lactation and a good aesthetic result. This method of treatment does not require hospitalization and is carried out on an outpatient basis.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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