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Research paper

Maternal adherence to guidance on breast milk collection process☆

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ABSTRACT

Introduction: Breast milk expression with a breast pump increases the risk of contaminating milk with pathogenic bacteria; how to decontaminate breast pumps is controversial. The aim of this study was to investigate maternal adherence to updated French guidance on the breast milk collection process, including breast pump decontamination, and to identify potential sources of increased bacterial counts in breast milk in order to improve prevention messages to mothers.
Methods: Descriptive prospective study conducted between November 2015 and April 2016 in a French tertiary perinatal center. Oral and written instructions on the breast milk collection process and breast pump decontamination were given to mothers by trained healthcare professionals. Mothers whose neonates were admitted to the neonatal care unit and expressing milk for the human milk bank were eligible if breast milk bacterial counts before pasteurization were $\geq 10^6$ colony-forming units (cfu)/mL for total aerobic flora or $\geq 10^4$ cfu/mL for *Staphylococcus aureus*. Maternal adherence to the guidance was investigated with a questionnaire and a face-to-face interview.
Results: One hundred and fourteen mothers with neonates admitted to the neonatal care unit expressed milk for the milk bank; 44 (39%) were eligible and 29 (66%) included: most of them (76%) with increased counts of total aerobic flora in breast milk and 24% with increased counts of *S. aureus*. At least three divergences from the guidance provided were reported for 16 mothers (55%). The most frequent ones were inadequate storage of the breast pump collection kit (62%), ineffective decontamination of the breast pump collection kit (52%), inappropriate cleaning of the breast pump (48%), and inadequate breast milk transport from home to hospital (31%).
Conclusion: Despite standardized instructions, mothers with increased bacterial counts in breast milk frequently declared several divergences from the guidance on the breast milk collection process. Giving mothers and any person of their choice repeated clear instructions with illustrated guidance, demonstrations, and practice may help improve the microbiological safety of expressed breast milk.

1. Background

Breastfeeding is widely recognized as the optimal feeding for premature neonates [1–3], but also for those with severe gastrointestinal diseases [4]. For these breastfeeding mothers, breast milk expression, either manually or with a breast pump, is a major issue. It is now acknowledged that breast milk is not sterile [5] and contributes to the establishment of the intestinal microbiota in neonates [6]. Nevertheless, expressing, processing, and storing breast milk may disturb its commensal flora and lead to the establishment of pathogenic bacteria [7,8]. Case reports of severe infections in neonates have been attributed to increased bacterial counts in breast milk owing to the breast milk collection process [9–11], although the causal link is not formal [12], or to the contamination of a milk bank pasteurizer [13].

The potential sources of breast milk bacterial contamination should be addressed to ensure its microbiological quality. Proper hand washing is known to be a crucial factor [14]. As for the decontamination of the breast pump collection kit, limited good-quality evidence is available in the literature; a variety of processes may be used but all of them have drawbacks or risks [15]. Guidelines on the breast milk collection process have been published recently in several countries, including France [16–18]. They

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represent good practice based on the consensus view of working groups and agree on many points. In particular, they recommend not providing a sterile breast pump collection kit for every milk expression session by the same mother but using a standard wash, rinse, and dry method to reduce bacterial load to acceptable levels. In addition to the decontamination of the breast pump collection kit, other factors such as breast milk storage and transport or breast lesions may be involved in the bacterial contamination of breast milk.

Increased bacterial counts in breast milk are a major issue for human milk banks. In France, breast milk should be discarded if bacterial counts before pasteurization are 10^6 colony-forming units (cfu)/mL or more for total aerobic flora or 10^4 cfu/mL or more for *Staphylococcus aureus* [19]. French guidance on the breast milk collection process and breast pump decontamination in neonatal care units was published in 2013 [17]. As part of the hospital's baby-friendly accreditation ("initiative hôpital ami des bébés"), standardized training for healthcare professionals was planned in our tertiary perinatal center to implement this guidance. In this study, we describe the breast milk collection process, including breast pump decontamination, followed by mothers in case of increased bacterial counts in breast milk, 1 year after full implementation of the guidance and training of healthcare professionals, in our perinatal center. We aimed to investigate maternal adherence to the guidance and to identify the potential sources of increased bacterial counts in breast milk in order to improve prevention messages to mothers.

2. Methods

2.1. Study design and setting

This descriptive and prospective study was conducted between 1 November 2015 and 30 April 2016 in a tertiary perinatal center, implemented in the Lille Regional University Hospital (France) with around 5600 births per year, a 62-bed neonatal care unit, and a regional human milk bank. Approximately 700 healthcare professionals (midwives, pediatric nurses, caregivers, paediatricians, obstetricians) are likely to inform mothers about breast milk collection process and breast pump decontamination. All were trained for this purpose in 2014–2015, following the French guidance step by step [17]. Local policies were then to give oral and written instructions to breastfeeding mothers before delivery or as soon as neonates were admitted into the neonatal care unit (Appendix 1 and 2). Since the architecture in our neonatal care unit did not allow proper decontamination of the breast pump collection kits, sterile kits were used for every expression session in the neonatal care unit and reusable kits at home, in agreement with the local neonatal and hygiene departments.

2.2. Population

The study focused on breastfeeding mothers whose neonates were admitted to the neonatal care unit during the study period and who gave breast milk to the milk bank. Breast milk could be expressed either at home or at the hospital. Mothers were eligible if their frozen thawed milk contained bacterial counts above the accepted limits, in accordance with French regulations for human milk banks (total aerobic flora $\geq 10^6$ cfu/mL or *S. aureus* $\geq 10^4$ cfu/mL). In addition, we defined total aerobic flora as balanced if no single or preponderant morphotype of bacteria was observed. Exclusion criteria were mothers with neonates transferred to another hospital before they could be given the questionnaire (Appendix 3), mothers unavailable for a face-to-face interview, and neonatal deaths.

2.3. Data collection

As soon as increased bacterial counts in breast milk were identified, the mother was given a questionnaire, and a face-to-face interview was proposed. In addition to maternal and neonatal characteristics, the process of breast milk collection and the decontamination of the breast pump collection kit at home were collected, following the French guidance step by step [17]. Adherence to the guidance was defined as reported in Table 1. Divergences were defined at each step as nonadherence to the guidance. Breast pain or lesions were also investigated and mothers' breasts were examined by a trained healthcare professional.

2.4. Ethics

Maternal consent was obtained for the study. The database was anonymized and declared to the French Data Protection Authority (Commission nationale de l'informatique et des libertés). No ethical approval was needed.

2.5. Statistical analyses

Data are presented as proportions of events and medians with their interquartile ranges (IQR) (1st quartile–3rd quartile). The characteristics of the included and excluded populations were compared using *t*-tests or Wilcoxon tests for the quantitative variables, and Chi^2 tests or Fisher's exact tests for the qualitative variables, as appropriate; a *P*-value less than 0.05 was considered significant. Statistical analyses were performed with R software (version 3.1.2).

3. Results

3.1. Population

During the study period, 492 neonates born from 456 mothers were admitted into the neonatal care unit; 114 mothers expressed breast milk for the milk bank and among them, 44 (39%) were eligible for the study (Fig. 1). Increased counts of total aerobic flora and *S. aureus* in breast milk were identified in 34 (76%) and 10 (24%) eligible mothers, respectively. Aerobic flora was balanced in 21 of 34 mothers (Fig. 2). The median time between birth and the diagnosis of increased bacterial counts in breast milk was 12 days (IQR [9–22]). Among the 44 eligible mothers, 29 were included in the study. Maternal and neonatal characteristics, as well as the median time between birth and the diagnosis of increased bacterial counts, and the proportion of mothers with increased aerobic flora in breast milk, were not statistically different between the included and excluded populations (Table 2).

3.2. Breast milk expression

Three mothers (10%) received prenatal information about the breast milk collection process, but all had postnatal information. All but one used a double electric breast pump to express milk. The median number of milk expression sessions per day was six (IQR [5,6]). The place (home or hospital) where breast milk was expressed was not specified.

3.3. Maternal adherence to the French guidance in association with breast pain or lesions

Fewer than two divergences from the guidance were reported by eight mothers (28%), and three or more were identified in 16 (55%) (Fig. 3). Inadequate storage (62%) and ineffective decontam-

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