Review paper

Nipple candidiasis and painful lactation: an updated overview

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Adv Dermatol Allergol 2022; XXXIX (4): 651–655
DOI: https://doi.org/10.5114/ada.2022.116837

Abstract

Nipple pain and discomfort during or after breastfeeding remains one of the most common reasons for premature cessation of lactation among the affected women. The belief that yeasts, and especially *Candida* spp., are responsible for such symptoms is highly supported by many physicians, midwives, or lactation specialists, but is also viewed with scepticism by other health care providers. The aim of this paper is to provide an updated report of the evidence against, as well as in favour of, the "*Candida* hypothesis". Several studies have documented that lactating women with symptoms such as nipple soreness, with or without radiating breast pain, are more likely to test positive for *Candida* spp. than non-symptomatic women. However, its role as an undisputable aetiopathogenic factor for infection in these cases cannot always be established. Physicians should evaluate thoroughly such patients, because early and correct recognition of the underlying problem can prevent phenomena of early weaning.

Key words: candida, lactation, nipple pain.

Introduction

Nipple pain during lactation is among the most common reasons forcing mothers to discontinue breastfeeding, despite the undisputable benefits of breast milk in an infant's health, both in terms of nutritional value as well as immunological protection and emotional development [1, 2]. Studies showing that up to 96% of mothers experience pain during the first 6 weeks of lactation are present in the literature [2]. Although numerous factors can contribute to the development of such symptoms, including false positioning of the infant on the breast, nipple vasospasm, or nipple dermatitis, a large number of these cases are empirically attributed to nipple candidiasis [2–4]. On several occasions, diagnosis is based only on optical assessment of the breast, without the conduction of accompanying laboratory testing, such as nipple/breast milk culture or polymerase chain reaction (PCR) [3, 5]. Contradicting data concerning the association between nipple pain and the presence of yeasts either on the nipple or in the breast milk are available, thus generating an ongoing controversy on this matter [3, 6].

Aim

This report aims to summarize all existing information on the role of Candida species in painful breastfeeding.

Material and methods

This study was conducted according to the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews) for systematic reviews. The databases Medline (PubMed), SCOPUS, and EMBASE were thoroughly searched using the following Mesh key terms: "nipple pain" or "breastfeeding" or "lactation" AND "Candida" or "candidiasis" or "mammary candidiasis". Further papers were identified from the reference lists of the above retrieved papers and citations. Our search included articles in English that were published between 1991 and 2018. The selection process of the reviewed papers included firstly the screening of titles and abstracts, and secondly the evaluation of full text articles.

Results

Painful nipple is a condition characterized by intense nipple pain and a burning sensation or soreness, eventually radiating into the breast, during or after breastfeeding [7]. The nipples may appear mildly pinkish or red, irritated, shiny, or even eczematous with fissures; however, there is no sign of cellulitis, fever, or other systemic symptoms [7, 8].

One of the largest studies that associate the presence of *Candida* spp. with a reported burning sensation of the

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Received: 11.11.2020, **accepted:** 29.01.2021.

nipples during lactation is the longitudinal descriptive survey by Amir *et al*. involving 360 breastfeeding women over a period of at least 2 months postpartum [6, 9]. Burning nipple pain was reported by 32% of the participants during the study period [6]. Participants with nipple/breast thrush showed a higher probability for detection of *Candida* spp. in their in nipple/breast milk/baby oral samples (54%) compared to women without such symptoms (36%, $p = 0.014$) [6]. Notably, the detection of *Candida* spp. in this study occurred with the help of molecular techniques, such as real-time polymerase chain reaction (RT-PCR), and not with the use of microbiological cultures [6]. Similar results were documented in the study by Andrews *et al*. in 98 breastfeeding women [10]. In this study, 20 participants reported burning and/or sharp nipple pain associated with radiating breast pain during or after lactation [10]. Although breast milk cultures were positive for yeasts in 30% of the symptomatic women compared with 7.7% in the asymptomatic group, the majority of patients with pain (70%) showed no *Candida* spp. in their examined breast milk/nipple cultures [10]. In the cases where yeasts were indeed detected, *Candida albicans* was the most commonly isolated species [10]. Further studies that corroborate the *Candida* hypothesis are present in the literature [11–13]. In a study by Amir *et al*., which that compared the microbiological status of 61 lactating women with nipple pain against 64 lactating women without nipple pain and 31 non-lactating women, *C. albicans* was detected via microbiological culture in the nipple and/or breast milk more frequently in lactating women with nipple pain ($n = 11$, 19%) compared to the control group ($n = 2$, 3%) [11]. The authors note that *C. albicans* was detected in the infant's mouth in 10 out of the 11 cases among the lactating women with nipple pain and positive cultures for *C. albicans* in the nipple and/or breast milk, whereas no *C. albicans* could be detected in non-lactating women [11]. These facts lead to the hypothesis, that *C. albicans* was transmitted to the mother's nipple through the infant's mouth [11]. This hypothesis is supported by other reports, which attribute the origin of the infection to a maternal vaginitis, transmitting to the mouth of the infant during vaginal delivery [14, 15]. Attention must be given also to the possibility of *Candida* spp. biofilm formation on silicone surfaces and latex pacifier nipples because there is increasing evidence that their use is associated with the development of infant candidiasis [16]. Whether *Candida* would remain in the nipple as a commensal or as a pathogen was dependent on other parameters, such as a local irritation of the nipple, or recent use of antibiotics, with a negative effect on the normal bacterial flora of the nipple and breast area [11]. The theory of infant-to-mother transmission in the study by Amir *et al*. was supported by the fact that the main pain level had decreased in all affected participants 1 week after initiation of systemic and topical antifungal treatment for the mother, as well as topical antifungal treatment for the infant [11]. A study comparing the prevalence of *C. albicans* in the nipple and in the breast milk of 20 lactating women with superficial nipple pain versus 20 lactating women with deep breast pain and versus 20 non-symptomatic lactating women concluded that the yeast was found twice as frequently in the first group compared to the second group, while only 3/20 of the non-symptomatic participants demonstrated yeast colonization in their nipple and/or breast milk samples [12]. Similar conclusions in a different study context are shown in the prospective study by Francis-Morrill *et al*. [13]. In this survey the authors explored the sensitivity and positive predictive value of *Candida*-associated symptoms based on the detection of *Candida* species on the nipple and/or in the breast milk [13]. Nipple and/or breast milk cultures were obtained from 100 healthy lactating mothers at 2 weeks postpartum [13]. The participants were interviewed with regards to the following signs and symptoms between 2 and 9 weeks postpartum: sore or burning nipple/areola, non-stabbing breast pain, stabbing breast pain, shiny skin of nipple/areola, and flaky skin of nipple/areola [13]. The authors concluded that the positive predictive value for the presence of *Candida* spp. was highest when at least 3 of the aforementioned signs or symptoms were present, or when flaky or shiny skin of the nipple/areola was reported together or in combination with breast pain [13]. Studies examining the use of PCR as a potential diagnostic method for the detection of yeasts in the diagnosis of nipple thrush also suggest an association between nipple pain and *Candida* overgrowth [17]. In a study by Panjaitan *et al*. 65% of lactating women with nipple pain showed a *Candida* colonization, compared to 33% in the control group [17]. However, the authors state that, because the proportion of positive results using PCR was not as high as expected, it remains unclear whether this type of testing is actually cost-effective for everyday practice [17]. These results contradict with the conclusions of the study by Mutschlechner *et al*., in which the use of RT-PCR resulted in high rates of *C. albicans* detection in human breast milk samples, contrary to the microbiological culture [18]. In this prospective and monocentric survey, 43 lactating women who suffered from painful nipples with or without radiating breast pain and with or without skin changes, as well as a control group of 40 asymptomatic breastfeeding women, were subjected to analysis of breast milk for yeast infection via culture and via RT-PCR [18]. While *Candida* spp. was detected via culture in 8.8% (4/46) of the patient milk samples and 9.3% (4/43) of the control group milk samples, the use of RT-PCR resulted in significantly higher detection rates of *Candida* spp. (67.4% and 79.1% of the patient and control samples, respectively), revealing a potential low sensitivity and specificity for the detected yeasts [18]. For this reason, as well as the fact that with a negative culture the clinical relevance of a positive RT-PCR result is rather unclear and could also reflect

a *Candida* skin colonization, the authors concluded that RT-PCR is not to be recommended for the diagnosis of nipple or mammary candidiasis [18].

Studies have also been conducted to identify predisposing factors for nipple candidiasis [19]. In the retrospective case control study by Tanquay *et al*., a statistically significant correlation could be documented between nipple candidiasis and vaginal candidiasis, prior antibiotic use either due to mastitis or due to other reasons, and nipple trauma [19, 20]. Among other theories regarding the facilitated over-colonization by *Candida* spp. of the nipple area – and potentially also of the infant's oral cavity – is the fact that the residual breast milk that is found on the surface of the nipples as well as on the oral mucosa of the lactating infants is of significant nutritional value for the growing yeast [21]. Further predisposing factors include nipple maceration due to inadequate clothing and prolonged wearing of breast pads, steroid use, and oral contraceptives [8]. Gestational diabetes has also been linked with the development of nipple candidiasis [22]. The role of diet as a predisposing factor for nipple candidiasis remains controversial [8, 23]. Some authors advocate that excessive consume of dairy products, sugar, or artificial sweeteners can predispose women to *Candida* spp. overgrowth [23], while others suggest that there is insufficient scientific evidence to support the role of dietary factors in nipple yeast infections [8].

As well as the studies that favour the *Candida* hypothesis [24], reports that aim to contradict the validity of this theory are also available [3]. In the study by Jimenez *et al*., breast milk from 30 lactating women with deep breast or nipple pain, as well as breast milk from 30 lactating women without pain or other symptoms ($n = 60$), was examined for the presence of microorganisms [3]. The participants had extracted their own breast milk, either using a breast pump or by hand [3]. Since the prevalence of *Candida albicans* was significantly higher among the pump users versus the women that had used hand extraction (42% vs. 8%), the authors suggested the possibility of contamination in the first group [3]. Therefore, breast milk extraction by hand expression was selected as the method of choice to analyse the breast milk of a second larger cohort of 529 lactating mothers with deep breast pain [3]. 393 out of the 529 participants reported also superficial nipple pain and soreness [3]. The specimens from all patients were subjected to culture, PCR, and optical microscopy [3]. The 393 women with the reported nipple soreness provided nipple swabs, as well [3]. A statistically significant difference was found concerning bacterial growth, such as *Staphylococcus aureus* in the first cohort of 60 patients among women with painful breastfeeding compared to the healthy participants, both in the pump and the manual extraction groups [3]. However, as far as yeasts were concerned, a difference of count among the 2 groups was documented only when the specimen was extracted via pumping [3]. With regards to the second group of the 529 symptomatic breastfeeding women, *Candida* spp. was found only in 2% of the samples [3]. The nipple swabs of the 393 women with reportedly sore and burning nipples tested negative for yeasts but positive for bacterial growth [3]. Similar results can be seen in the study by Hale *et al*., which assessed the presence of *Candida* spp. in the breast milk of 16 symptomatic lactating women versus 18 healthy lactating women [25]. No significant differences in the detection of *Candida* spp. were seen among the 2 populations [25]. Although the authors expressed certainty concerning the absence of *Candida* spp. in the ductal system – also because a "systemic" candidiasis is practically inexistent in a healthy individual – they could not rule out the presence of yeasts superficially in the skin of the nipple/areola [25]. According to the authors, this finding would reflect rather a skin contamination of the nipple/areola region with the oral flora of the infant [25]. A metagenomic analysis of breast milk samples among 10 lactating women with breast and/or nipple pain in another study by Jimenez *et al*., as well as a microbiological analysis with the use of culture-dependent and culture-independent (PCR-DGGE, denaturing gradient gel electrophoresis) methods in the breast milk of 10 lactating women with mastitis in a study by Delgado *et al*., showed no signs of *Candida* spp. presence [26, 27]. In a survey by Kaski *et al*., which was conducted in 35 lactating women with radiating and penetrating or non-penetrating breast pain with or without nipple soreness, as well as in 35 non-symptomatic lactating women ($n = 70$), the *Candida* hypothesis was partly confirmed, because none of the control group participants but 8 of the case group participants showed growth of *C. albicans* in their breast milk samples ($p < 0.01$) [28]. It is, however, important to reflect on the following facts: *C. albicans* was isolated only in 23% of the symptomatic women [28]. Furthermore, there were no statistically significant differences between the symptomatic women with or without positive testing for *C. albicans* as far as clinical presentation and symptoms were concerned [28]. These facts suggest that many cases of nipple pain that are empirically attributed to a *Candida* spp. infection, end up receiving an unnecessary antifungal treatment [28]. The rate of lactating women with nipple pain during or after lactation, who showed signs of infection with *C. albicans* was documented to be low also in the study by Kent *et al*. (5 cases in which *C. albicans* was detected in nipple swabs and/or breast milk out of the 53 suspected infectious cases among a study group of 162 symptomatic women) [29]. In a survey by Graves *et al*. no *Candida* spp. was detected in nipple swabs or in the breast milk of 28 lactating women with nipple soreness [7]. Further reports indicating that the probability of an actual *C. albicans* infection is rather low among lactating

Table 1. Koch's postulates for establishing the microbiological aetiology of infection and disease

Koch's postulates concerning the aetiology of infection
The microorganism must be found in diseased but not healthy individuals
The microorganism must be cultured from the diseased individual
Inoculation of a healthy individual with the cultured microorganism must recapitulate the disease
The microorganism must be re-isolated from the inoculated, diseased individual and matched to the original microorganism

women with painful nipples are published in the literature [30, 31]. Taking into consideration all the above facts, several authors state that Koch's postulates (Table 1) concerning the identification of a specific causation for an infectious disease [32] are not actually fulfilled in the case of yeasts and nipple pain [3, 15, 32]. Therefore, there is insufficient solid evidence to support the *Candida* hypothesis in this case [3, 15].

Discussion

Pain and discomfort during or after breastfeeding, together with insufficient milk supply or lack of support from the family and work environment, is one of the most common factors that potentially leads breastfeeding women to premature weaning [10]. Candidiasis as an aetiological factor of nipple pain among lactating women remains a source of controversy and debate among physicians and lactation specialists [6]. The belief that yeasts are the most frequent cause for nipple soreness during lactation is widely adopted not only by the patients, but also by midwives and lactation consultants, leading to possibly unneeded empirical antifungal treatments, often without beneficial result [3]. It is crucial to correctly identify the underlying cause of painful breastfeeding in lactating women, without disregarding other important differential diagnoses, because adequate management of this disturbing condition can lead to significant symptom relief and therefore promote the continuation of breastfeeding [2].

Conflict of interest

The authors declare no conflict of interest.

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