REVIEW ARTICLE

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Nipple trauma in lactation – literature review

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Abstract

Introduction and Objective. Breastfeeding is beneficial for both mother and her newborn. Nipple trauma is a common problem in breastfeeding women. It negatively affects the quality of life of the new mothers and may be a reason for early weaning. The main aim of the paper is to summarize current knowledge about nipple wounds and trauma in lactation, based on recent literature.

Review Methods. A search was undertaken of the PubMed, Web of Science, Google Scholar and Wiley databases for articles in English regarding nipple wounds in lactation. Key words "nipple wound lactation", "nipple wound breastfeeding", "nipple trauma lactation", "nipple trauma breastfeeding", "nipple injury lactation", "nipple injury breastfeeding", "nipple candidiasis", "ankyloglossia breastfeeding" were used. Evaluation was based on the titles of articles, abstracts and full text. Main criteria for including the publications were whether they raised the problem of nipple trauma in lactation.

Brief description of the state of knowledge. Breastfeeding is physically and mentally beneficial for both mothers and infants. Pain and damage to the nipple may affect the lactation period negatively and cause early cessation of breastfeeding. Nipple damages that may occur in lactation are cracks and fissures, abscesses, blisters, scabbing, erosion of the tissue or bleeding. Open wounds may also be present.

Summary. Awareness, early detection and proper management of nipple trauma occurring in lactation is the key to successful and painless breastfeeding. New mothers should be educated about lactation as a process, breastfeeding techniques regarding both their position and baby positioning, and early symptoms of potential nipple trauma by trained personnel. Choice of treatment is based on the type of nipple trauma.

Key words

pregnancy, lactation, breast feeding, wounds and trauma

INTRODUCTION

Breastfeeding is recommended by the World Health Organization (WHO) as an exclusive feeding method for approximately six months, with the possibility of extending this period to one to two years as a complementary method, due to its immunoprotective matter and providing nutrients essential for positive infant development and growth [1–4]. In addition to its nutritional value, breastfeeding has a positive influence on the behaviour, cognition and mental health of both the mother and her baby [5]. It is also beneficial as it reduces the risk of breast, ovarian or endometrial cancer, endometriosis, diabetes mellitus and hypertension [6, 7]. Early after delivery, sucking the nipple by the infant leads to uterine involution and bleeding reduction as oxytocin is released [7]. In a longer period of time, breastfeeding may reduce the risk of development of osteoporosis in future [7]. Although, there are situations, such as milk deficiency, mastitis, nipple damage, blebs, chronic pain or both malignant and benign breast masses, that may lead to early breastfeeding cessation. The result is that breastfeeding rates are below recommended levels [8, 9].

Nipple damage is believed to be one of the most frequent causes of early weaning, due to causing pain and discomfort for breastfeeding mothers [3, 10, 11]. Nipple trauma is a visible cutaneous lesion of the nipple and areola [12]. Initial symptoms of potential nipple damage in most case are erythema and swelling [10]. Damage appearing during lactation include nipple cracks and fissures, abscesses, blisters, scabbing, skin peeling, tissue erosion or bleeding [2, 13, 14]. Slight damages can turn into open wounds of the papilla [15]. Among skin diseases of the breast and nipple that typically do not cause wounds and that can be linked with pregnancy or lactation, one can list atopic dermatitis, allergic contact dermatitis, irritant contact dermatitis, psoriasis, hiperkeratosis and Fox-Fordyce disease [16]. Another important issue is lactation mastitis, according to a wide array of literature, but it exceeds the scope of this paper. However, it is a subject that certainly requires attention when analyzing lactation-connected issues. Physicians should take into consideration that nipple wounds may be a sign of malignant transformations in the breast and it is vital to stay vigilant [16].

It is also important for healthcare workers to remember that they should prepare new mothers for the possibility of breastfeeding problems and raise their awareness in this subject, as the length of postpartum stay in hospital is being reduced and women are not supported on returning home [17]. New mothers should be taught by trained staff how to properly feed their baby, or how to express milk to reduce the risk of nipple injury followed by infections [6, 18]. One-to-one breastfeeding education is believed to be an effective technique in preventing nipple injuries [19]. Raising awareness among healthcare workers about the

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problem of nipple trauma during lactation is important, as they are supposed to provide education for mothers [20]. Both healthcare professionals and new mothers should be educated in the topic of early signs of nipple trauma and damage to ensure that this condition is properly recognized, which is important to avoid further escalation of the problem, and for prompt implementation of treatment [20].

MATERIALS AND METHOD

For the purpose of this review, a manual search was undertaken of the PubMed, Web of Science, Google Scholar and Wiley databases for articles in English regarding nipple wounds in lactation. Key words 'nipple wound lactation', 'nipple wound breastfeeding', 'nipple trauma lactation', 'nipple trauma breastfeeding, 'nipple injury lactation', 'nipple injury breastfeeding', 'nipple candidiasis', 'ankyloglossia breastfeeding' were used. The search was focused on articles published in between 2017 – 2023, together with their references. Evaluation was based on titles, abstracts and full texts. Main criteria for including the publications was that they dealt with the problem of nipple wounds trauma in lactation.

FACTORS THAT MAY CAUSE NIPPLE WOUNDS IN LACTATION

Hyperlactation. Hyperlactation or hypergalactia is a state of oversupply of human milk, as the production is greater than the demands needs of the baby for positive growth. An infant requires 450 ml – 1200 ml of human milk for adequate development; therefore, milk production in excess of this amount is considered hyperlactation. Hypergalactia may be a reason for nipple pain, blebs or mastitis, and may result in nipple traumas. Management is based on excluding behaviourally self-inducted or iatrogenic hyperlactation – block feeding, herbal therapies and medications – pseudoephedrine or combined oral contraceptives. Dopamine agonists should be saved for resistant cases of hyperlactation, mostly idiopathic. Cabergoline is preferred. Serious side-effects of this group, such as inhibition of milk production, should be taken under consideration during administration [21].

Breast cancer. Breast masses, both malignant and benign, should be carefully diagnosed and observed when occurring in lactation [6, 22]. Because there is a possibility of misdiagnosing breast tumour as a nipple or breast trauma, physicians need to stay alert to a possibility of the development of a malignant breast mass, as breast cancer is the most common tumour in women worldwide. In some cases when breast cancer occurs in breastfeeding women, there is a possibility to perform surgery during lactation. Women who undergo such operations may develop wound complications, such as infection at the site of the operation side or milk fistulas. In such cases, unilateral breastfeeding and decreased milk production are issues that need to be addressed. Another potential risk factor of breast and nipple wounds is post-operative breastfeeding during radiation therapy which carries the risk of skin damage. Chemotherapy, targeted anti-HER2 therapy and endocrine therapy are indications for the cessation of breastfeeding, and cabergoline is implemented for the inhibition of lactation [22].

Lactation-connected breast phlegmon or abscess. Phlegmon and abscess are nipple damages during lactation that require further diagnostics. Phlegmon, as it may occur as an inflammatory or non-inflammatory condition, may be related to mastitis or abscesses, and is formed in connection with the duct system of the breast. It presents as a tender mass with erythema. Management of the phlegmon includes antibiotic therapy and invasive methods, such as drainage or aspiration [23, 24].

An abscess may form as a complication of untreated or incorrectly managed mastitis and occurs as a well-circumscribed mass filled with fluid. There is the possibility of progressing into phlegmon. Treatment is similar to phlegmon management [23].

Ankyloglossia of the infant. Ankyloglossia is a congenital malformation that restricts the protrusion of the tongue beyond the lower gum. This is caused by an abnormally thickened or too short lingual frenulum [25]. Ankyloglossia in infants causes difficulty in sucking and therefore less milk excretion. It can lead to early weaning due to pain, discomfort, and nipple injury of the mother [25, 26]. Nipple trauma can occur in the form of bleeding, cracking and soreness. In severe cases, this leads to mastitis and clogging of the milk ducts [27]. During breastfeeding this defect may interfere with the correct attachment and sealing of the nipple [28]. Currently, there are no single diagnostic symptoms, which leads to mistakes in the diagnosis of ankyloglossia [29]. The characteristic feature described by the defect when the tongue is raised is the heart-shaped tip of the tongue. In a study by Messner et al. it has been shown that 25% of newborns with a short frenulum have problems with consuming food sucking milk from the mother's breast [28]. It is believed that approximately 50% of cases of ankyloglossia in infants do not lead to problems with breastfeeding. When problems with feeding an infant are present, surgery may be useful – frenulotomy with laser or scissors is the most common procedure [28, 29].

Viral infections. The herpes simplex virus (HSV) usually appears as a vesicle that may be transform into ulceration or complexes of these lesions. In the case of HSV infection in breastfeeding women, the breast should be separated from the infant. Treatment should include acyclovir or valacyclovir as these drugs are safe during lactation. The varicella zoster virus presents as multiple vesicles in the nipple area, and infection may be extremely dangerous for the infant. Separation of the baby from the breast and administration of medication (administered as in HSV infection) should be implemented [30].

Nipple candidiasis. Candida albicans is the most frequent commensal fungus occurring in the human body [31]. Sore, burning nipples, or 'shooting' pain into the axilla, without fever or flu-like symptoms in lactating women, have often been diagnosed as 'ductal or mammary candidiasis' by many physicians only on the basis of an optical examination of the breast, without additional laboratory tests [32]. However, it cannot be confirmed in 100% that it is the etiopathogenic factor of infection in such cases [33]. Despite the lack of

scientific evidence confirming the relationship between Candida spp. and nipple and breast pain, many physicians, midwives and lactation consultants still believe in such a relationship [32]. The longitudinal descriptive survey by Amir et al. in 2011 involving 360 breastfeeding women links the presence of Candida spp. with a reported burning sensation of the nipples during lactation. A greater probability of detecting Candida spp in nipple or breast milk or oral samples from a baby was demonstrated in mothers with nipple or breast mycosis (54%), in contrast to women without such symptoms (36%) [33].

In a study by Hale et al., the milk of 16 symptomatic lactating women was compared with that of 18 healthy lactating women for the presence of Candida spp. There was no significant difference in the detection of Candida spp. between symptomatic and asymptomatic women [33]. Some studies have shown that coagulase-negative Staphylococci (CNS), Streptococci (mitis and salivarius groups) and Corynebacteria may be associated with these symptoms [32]. Anti-fungal treatment has also not been shown to result in faster resolution in women with these symptoms [34].

SELECTED STUDIES OF NIPPLE TRAUMA IN LACTATION

The topic of nipple wounds in lactation has been researched previously worldwide. Haifeng Gao et al. focused on the role of education of the family and its results on nipple cracks prevention. 182 pregnant women in an experimental group were evaluated, of whom 161 mastered the correct breastfeeding position, while the rest did not. In a control group of 160 mothers, 102 mastered the position, and 58 did not. Results showed that in the experimental group, 42 of the mothers (23.1%) presented nipple cracks. In contrast, in the control group, 75 of the women (46.9%) experienced nipple damage. The conclusion was that the role of professional training regarding breastfeeding techniques and positions results positively in the reduction of nipple damage in new mothers [19].

Selected studies and their findings on nipple trauma in lactating women are briefly summarized in Table 1 [9, 14, 15, 17, 20, 35–37].

Table 1. Summarized studies regarding nipple trauma

Study	Participants	No. and percent of patients traumatised nipples
Feenstra et al.	561	212 (38%)
Gianni et al.	552	158 (41%)
Vani Cirico et al.	1672	928 (55.5%)
Laageide et al.	219	22 (10.2%) – wounds 31 (14.4%) – redness or eczema
Nakamura et al.	50	29 (58%)
Shafaei et al.	108 (divided into 2 groups of 54)	25 (46.3%) – experimental group 16 (29.6%) – control group
Barbosa et al.	73	25 (34.2%)
Mahurin-Smith	457	175 (38.3%)

According to the literature and the data presented in Table 1, nipple trauma in breastfeeding women seems to be a common issue, its prevalence as listed in studies vary from 10 to even 58% of examined women. Nipple wounds negatively influence the quality life of the mother, and may be the reason for premature discontinuation of breastfeeding, which is unfavourable for both mothers and infants [2, 13].

DISCUSSION

According to the literature, from 13% – 92% of new mothers experience a variety of breastfeeding problems and complications that often lead to early weaning [17]. Complications regarding the nipples usually arise between 1–3 weeks after delivery [15].

Nipple wounds are considered an often occurring condition during breastfeeding, and are considered the most frequent cause of mastitis[17, 19]. Mothers not only report injury, but also healing problems and prolongation [17]. The healing process includes such stages as haemostasis, inflammation, proliferation and remodelling [30]. Haemostasis is based on forming platelets and fibrin clot to inhibit visible or non-visible bleeding, and neutrophils are attracted as a defence against potential bacterial infection. The inflammation process in which many biologically-active cells – such as neutrophils, macrophages, leukocytes and growth factors take part, results in scab and epithelial blister formation. The proliferation period is connected with granulation, collagen creation and neovascularization. During the remodelling process, keratinocytes fill-in the tissue deficit caused by the wound. Re-epithelialization leads to the final recreation of the nipple tissue [30]. It is worth remembering that some nipple wounds may not heal even after removing the causing factor, in such cases of chronic damage, debridement should be considered [19].

In the majority of cases nipple damage is associated with painful sensations. It is therefore important to remember that nipple pain without any trauma can be problematic for breastfeeding women, but the pain is more severe in connection with traumatised mammary papillae [3]. Nipple pain in most cases occurs initially in the first week postpartum [30]. According to the study by Pereira Coca et al., The Numeric Rate Scale or Visual Analogue Scale are the most relevant tools for measuring pain in women with nipples damaged due to breastfeeding [3]. In the scale of 0 – 10, women without visible nipple trauma reported a pain level of approximately 2.7, and those with visible trauma – a mean of 6.2 within the week after delivery, and 5.8 later on [30].

Among the potential risk factors of nipple pain, delivery via Caesarean section, Raynaud's syndrome leading to vascular constriction in the nipple, auto-immunological diseases, breast neoplasms and medication influence can be distinguished [15].

Human breast milk aside from essential nutrients, immune cells and bioactive components such as antimicrobial peptides, immunoglobulins, chemokines, cytokines, growth factors, oligosaccharides, glycoconjugates and fatty acids, features a dynamic site-specific microbiome that is abundantly diverse but has a low microbial load in comparison to other sites in a healthy human body [38, 39]. The maximum number of each bacterial taxonomic level detected per study was 58 phyla, 133 classes, 263 orders, 596 families, 590 genera, 1,300 species and 3,563 operational taxonomic units [39]. In most cases, the most prevalent cultivable bacteria in samples of milk from healthy women are typically Staphylococcus (Staphylococcus epidermidis and other coagulase-negative

species), Streptococcus (S. salivarius, S. mitis, and other species of the mitis group), Corynebacterium, Cutibacterium, and other taxonomically-related Gram-positive bacteria. Bifidobacteria and lactic acid bacteria (Lactococcus, Enterococcus, Lactobacillus, Leuconostoc, and Weissella) occur less commonly [40].

The presence of cells and/or nucleic acids from viruses, archaea, fungi, and protozoa have been found in some studies to be present in human milk. There is a certain amount of inter-individual heterogeneity in the milk microbiota. Mammary health and newborn colonization may be biologically affected by changes to its structure. There is relatively little information available at present about the effects of a wide range of factors, including genetic background, geography, milk sampling, maternal age, nutrition and BMI, delivery method, gestational age, therapies and dietary supplements [38–40].

According to the literature, the main reason for nipple trauma and damage to be latch problems [14]. Nipple injuries can be also caused by the vacuum and friction effect by an infant while sucking the nipple [41]. Among other risk factors for nipple damage one can distinguish frequent or dysfunctional sucking by the infant, inadequate breastfeeding technique, fair skin colour, no history of previous breastfeeding, and already present nipple cracks [14, 42]. It is worth remembering that preterm babies suckle the breast more weakly, which typically leads to lower frequency of traumas as the tissue is less affected [14].

On the other hand, according to ABM Protocols (Academy of Breastfeeding Medical Clinical Protocols), preterm babies tend to present disorganized and dysfunctional sucking that may be linked with potential nipple damage. Women with darker skin colour, which is linked with increased nipple pigmentation, tend to experience nipple injury less frequently. The type of nipple is also relevant. Vani Cirico et al. estimated that there is a higher prevalence of nipple trauma among women with semi-protruding, flat, inverted or pseudo-inverted nipples, rather than in women with protruding papillae [14].

Laageide et al. indicated that previous skin diseases, such as eczema, may be a potential risk factor of nipple damage while breastfeeding. Other reasons, according to these researchers, may be sensitive skin and previously existing nipple issues [14]. The position of both mother and infant during breastfeeding also tends to have an impact on nipple traumas.. According to the analysis by Zhi Wang et al., the lying back position is connected with a significantly less occurrence of papillas injuries, in contrast to traditional positions, such as cradle, cross-cradle, side-lying, and the football position which is popular among many mothers [15].

In the literature there are papers that do not link nipple piercing with nipple traumas when breastfeeding, as it is rather connected to reducing the milk supply, inhibiting milk outflow reflex, and increasing sensitivity of the papillas [43, 44]. Milk fistulas can also appear as the milk can flow through the pierced parts [44]. It is crucial to remember that nipple jewellry should be removed before starting breastfeeding, as it may interrupt the latch or be swallowed by the infant. Injuries of the oral cavity of the infant may also occur [43, 44].

There are many possible interventions in nipple wounds and trauma, but it is still not clear which is the most efficient [44]. Many studies pay attention to the proper fit of the child during feeding, fit and hold interventions ('latch and positioning') [15]. Studies show that the use of oils or human milk tends to be a method of choice [30]. Gentle cleaning, avoiding soapy products and using emolients are prevention techniques for maintaining a proper skin barrier. The moist and closed healing technique is recommended for nipple wounds [42]. A comparative study by Neto et al., assessed the use of HPA lanolin compared to breast milk for treating nipple pain and trauma in nursing mothers. The study showed a statistically significant improvement in the healing of injuries when using HPA lanolin [8, 15]. A clinical study by Vieira et al. shows that the combined use of breast milk with a breast shell was more effective than anhydrous lanolin in the treatment of nipple injuries [45]. In general, substances with a potential to develop allergic reaction, such as petroleum or lanolin, should not be administered when managing nipple traumas [46].

Other treatment methods include phototherapy, laser therapy, silver cap, hydrogel or polietylene use, Aloe vera or herbal therapy methods. Among these therapies, menthol oil and lanolin present increased healing of nipple fissures and injuries. Methods such as laser therapy, Aloe vera or silver cap seem to be more effective in pain reduction than for wound healing [8]. Another option used for the management of nipple pain or nipple trauma in lactating women is photobiomodulation therapy. This is a light therapy that uses non-ionizing forms of light sources (LEDs, lasers, broadband light). The process relieves pain and inflammation, promotes wound healing and tissue regeneration [13]. According to Niazi et al., menthol, hot water compresses and prevention of nipple injuries based on correct breastfeeding positioning, are the most effective therapies [47]. On the other hand, it should be taken into consideration that menthol oil may dry the skin [13]. Alcohol agents, antiseptics or soaps may lead also cause dry skin, and should not be used in cases of nipple wounds [15].

Currently, aspiration of a phlegmon or abscess is the preferred therapy instead of surgical drainage, although they are typically treated by drainage under local anaesthesia, because in most cases they are located superficially, and interventional radiology methods are not necessary [8]. Appropriate cleaning of the necrotic tissues of the breast during lactation supports the wound healing process, is the basis for treating chronic nipple injuries [8, 48].

Physicians should also be aware of the risk of the development of milk fistulas, which appear when surgical interventions during lactation are incorrectly performed. Treatment should consist of a small incision [49].

The treatment of choice for superficial bacterial infection associated with skin trauma is antibiotic therapy (cephalosporins or penicillinase), and a bacitracin or mupirocin ointment compound [8].

CONCLUSIONS

Breastfeeding is physically and psychologically beneficial for both the mother and her infant. Awareness, early detection and proper management of nipple trauma occurring in lactation is the key to successful and painless breastfeeding. New mothers should be supplied educated about lactation as a process, breastfeeding techniques regarding the position of both mother and baby, and early symptoms of potential nipple trauma by trained personnel.

Healthcare professionals should also be educated on the topic of early symptoms of nipple trauma in order to provide correct diagnosis and fast implementation of treatment. Management should be adjusted to the type of wound or trauma of the nipple, but potentially allergenic substances, such as lanolin, should be avoided.

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