

Case Report

Recurrent breast abscess with isolation of *Fusobacterium nucleatum*: a case report and review of oncogenic potential

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ABSTRACT

Breast abscesses are uncommon in non-lactating adolescents and are typically caused by common skin flora. *Fusobacterium nucleatum*, an anaerobic gram-negative bacterium primarily associated with periodontal disease, has recently been implicated in colorectal and breast tumorigenesis but is rarely identified in breast infections. We report the case of a 14-year-old previously healthy female who presented with a right breast abscess requiring incision and drainage (I&D). Initial cultures yielded anaerobic gram-positive organisms; however, following recurrence one month later with a larger abscess, operative cultures isolated *Fusobacterium nucleatum*. She was successfully treated with targeted intravenous antibiotics followed by a four-week oral course. This case highlights the importance of considering atypical anaerobic pathogens in persistent or recurrent pediatric breast infections. The identification of *F. nucleatum* in breast tissue raises questions regarding microbial dysbiosis and its potential long-term implications, underscoring the need for appropriate antimicrobial management and close clinical follow-up.

Keywords: *Fusobacterium nucleatum*, Non-lactational mastitis, Pediatric breast abscess, *Fusobacterium* infections, Dysbiosis, Breast neoplasms

INTRODUCTION

Breast infections in adults are relatively uncommon and occur predominantly in lactating women, presenting as mastitis most often, and rarely as abscesses.¹ Non-lactational abscesses tend to occur more often in the fourth decade.²

Mastitis and breast abscesses are relatively uncommon in the pediatric population, especially in post-neonatal, non-lactating females. When they do occur, they are most often due to common skin flora such as *Staphylococcus aureus* or *Streptococcus spp.*¹ Persistent, recurrent, or refractory infections, especially in pediatric or non-lactating adolescent females warrant further evaluation,

including imaging and microbiological studies, to rule out atypical pathogens or underlying pathology.

Fusobacterium nucleatum is an anaerobic, gram-negative bacterium most commonly associated with periodontal disease. However, emerging literature has implicated this organism in the development and progression of several malignancies, including colorectal and breast cancers. Its presence in breast tissue, particularly in the absence of typical risk factors or predisposing conditions, raises important questions about its potential role in oncogenesis, which has rarely been described.^{3,4}

In this report, we present the case of a 14-year-old female with recurrent right breast abscesses, where wound

cultures ultimately grew *Fusobacterium nucleatum*. This case highlights the importance of considering atypical pathogens in recurrent breast infections and raises awareness of the possible long-term implications of microbial dysbiosis in breast tissue.

CASE REPORT

A 14-year-old previously healthy female presented to the emergency department with complaints of right breast swelling, tenderness, and fever for several days. She had been treated a week prior with oral trimethoprim-sulfamethoxazole (Bactrim) for presumed mastitis and cellulitis, but her symptoms persisted despite medication adherence. She denied any associated respiratory or gastrointestinal symptoms, though she endorsed intermittent headaches.

Upon initial ED evaluation at a neighboring hospital, she was found to be febrile and tested positive for Influenza A. Laboratory findings were notable for leukocytosis of 15.4, elevated C-reactive protein (CRP) of 2.40 mg/dL, and elevated erythrocyte sedimentation rate (ESR) of 27. The bedside ultrasound suggested findings consistent with mastitis. On exam, her right breast was significantly enlarged, indurated, and tender, without overt drainage. The patient was transferred to our institution for intravenous antibiotic therapy, piperacillin-tazobactam (Zosyn) and vancomycin at first. She underwent bedside needle aspiration followed by bedside incision and drainage (I&D) by the surgical team. During the bedside I&D, there was approximately 75ml of purulent material evacuated with wound cultures obtained during the procedure. Wound culture yielded *Peptostreptococcus anaerobius*, a gram-positive, anaerobic bacterium, and *Actinotignum schaalii*, a Gram-positive, facultative anaerobic bacterium, and antibiotics were subsequently changed to ampicillin-sulbactam (Unasyn) based on the recommendation of an infectious disease (ID) consultant. The patient responded well, remained afebrile for over 72 hours, and was discharged home on five days of oral amoxicillin-clavulanate (Augmentin) with outpatient surgical and primary care follow-up. The patient completed the course of antibiotics but did not return for outpatient appointments.

Approximately one month later, the patient returned to the ED with recurrent symptoms of fever and right breast erythema. She was febrile to 102.1°F with associated tachycardia. Repeat labs revealed a WBC count of 10.3 and ESR of 18 within an acceptable range; however, CRP was elevated to 2.6 mg/dL. Imaging again suggested a possible abscess. She was admitted, restarted on IV antibiotic therapy, and underwent a second operative I&D. Intraoperative findings revealed a large abscess encompassing the entire right breast, with evacuation of approximately 200 ml of purulent material.

Notably, wound cultures from this admission grew *Fusobacterium nucleatum*, a gram-negative, anaerobic

bacterium, increasingly recognized in association with various malignancies. Blood cultures remained negative throughout hospitalization. After five days of Unasyn, the patient's clinical condition improved with resolution of fever and normalization of inflammatory markers. She was discharged home on an extended 4-week course of Augmentin with close outpatient follow-up for wound care and monitoring.

DISCUSSION

Fusobacterium nucleatum is a gram-negative, anaerobic bacteria typically found in the oral cavity and gastrointestinal tract. It is best known for its participation in periodontal disease. In recent years, it has gained significant attention for its potential role in the pathogenesis of various malignancies. Most notably, *F. nucleatum* has been strongly implicated in colorectal cancer, where it is thought to promote tumor progression by modulating the tumor microenvironment, suppressing immune responses, and enhancing inflammatory pathways.^{3,5,6}

Emerging literature suggests a growing link between *Fusobacterium nucleatum* and breast cancer. The bacteria gains access to breast tissue through multiple potential routes, including hematogenous spread, lymphatic dissemination, or even direct colonization via the nipple.^{7,8} Studies have shown that the bacteria are present in higher abundance within breast tumor tissues compared to healthy breast tissue, particularly in tumors expressing high levels of Gal-GalNAc a glycan commonly displayed on cancer cells. *F. nucleatum* expresses a lectin protein called Fibroblast Activation Protein 2 (Fap2), which specifically binds to Gal-GalNAc, enabling the bacteria to adhere to and colonize tumor tissue. This interaction has been shown to promote tumor growth and metastatic progression by suppressing the activity of tumor-infiltrating T cells.^{5,9} Additionally, studies have demonstrated that *F. nucleatum* can accelerate tumor progression by inducing DNA damage, promoting epithelial-to-mesenchymal transition, activating inflammatory pathways and resistance to cancer therapies, particularly immune checkpoint inhibitors to favor immune evasion.¹⁰

Mastitis and breast abscesses are relatively uncommon in the pediatric population, especially in post-neonatal, non-lactating females. When they do occur, they are most often due to common skin flora such as *Staphylococcus aureus* or *Streptococcus spp.* The detection of *F. nucleatum* in a pediatric breast infection, especially in the absence of typical risk factors, warrants further investigation. While a direct causal relationship between *F. nucleatum* and breast cancer in children has not been established, its presence in breast tissue could be indicative of microbial dysbiosis in the setting of chronic inflammation or an early marker of malignancy. *F. nucleatum* has been implicated in immune modulation within the tumor microenvironment. This

immunosuppressive effect is particularly concerning in pediatric patients, where immune system development is still ongoing.^{9,11}

This case underscores the need for broad microbial investigation in pediatric infections not responding to standard antibiotic regimens. The detection of atypical anaerobes like *F. nucleatum* influences antibiotic selection and also should prompt consideration of further diagnostic evaluation, especially in the setting of persistent or recurrent infections. Long term follow up is indicated as outcomes in these pediatric cases considering that the potential contribution to future neoplasms is unknown at this time.

CONCLUSION

This case illustrates an unusual presentation of recurrent mastitis and breast abscess in a non-lactating adolescent female, complicated by the isolation of *Fusobacterium nucleatum* a bacterium increasingly linked to tumorigenesis in breast tissue. While the long-term clinical significance in pediatric patients remains uncertain, the presence of this organism in the context of persistent infection suggests careful microbial evaluation, appropriate antimicrobial therapy, and close clinical follow-up for early identification of potential contributions to carcinogenesis, even in the pediatric population.

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