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Case report

Role of ultrasound in diagnosis of neonatal breast enlargement: a newborn case report ^{☆,☆☆}

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ABSTRACT

Neonatal breast enlargement is a hormone-related condition, mostly asymptomatic/physiological, with a well-recognizable sonographic appearance but limited data in the literature. It can be uni-or bilateral. Typically described in the first week of life, the transient lesion disappears spontaneously within 6 months. The main differential diagnosis is neonatal mastitis, a breast tissue infection that requires a specific antibiotic therapy. Knowledge of clinical and imaging findings is crucial, and ultrasound represents a reliable tool which allows a quick identification and an excellent examination of neonatal breast abnormalities. We aim to highlight sonographic classic features of benign neonatal breast enlargement showing how ultrasound rules out real breast masses helping to differentiate between it and mastitis when clinical and laboratory data are inconclusive. We describe a 2-day-old male with bilateral breast swelling more pronounced on the right side.

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Introduction

Breast enlargement with increased breast gland tissue represents a frequent condition that occurs during early childhood, puberty, or older age and is independent of the sex of the patient. It's attributable to the falling levels of maternal estrogen at the end of pregnancy, which influence the baby during fetal life. In men it is called gynecomastia. Radiologists lack familiarity with characteristic imaging of pediatric breast diseases, which often results in misdiagnosis [1]. Ultrasound examination (US) is a noninvasive and suitable initial imaging modality. The knowledge of normal sonographic features of neonatal breast enlargement is crucial for a quickly differential diagnosis of neonatal mastitis which instead obliges hospitalization and parenteral antibiotic treatment [2].

We present a male newborn who came to our observation, in an emergency, for a painless swelling of both breasts, redness of the skin since birth but no fever clinically mimicking an infective mastitis.

Case report

A full term, 2 days-old male patient who was admitted to our Emergency Department with bilateral breast enlargement, redness and tenderness and history of milk-like discharge from the right nipple at birth. The prenatal history included normal pregnancy with normal vaginal delivery and no maternal infections during the pregnancy. The neonate had no fever with slightly decreased activity but normal vital signs.

Bilateral breast examination symmetrically showed: an erythematous region overlying a palpable, non-tender sub-areolar mass (Figs. 1–2) with no evidence of enlarged axillary lymph nodes.

Laboratory tests detected: normal blood count, liver function, electrolytes, glycemia, creatinine and total immunoglobulins. Nasal swab was tested for methicillin-resistant *Staphylococcus aureus* by the polymerase chain reaction technique which was also normal.

Nevertheless, basing on the clinical findings the infant was admitted with the suspicion of neonatal mastitis and an antibiotic therapy was scheduled. Prior to start the administration of parental clindamycin therapy an ultrasound was performed. US was performed using high-frequency broadband linear transducers with central frequencies of 12 MHz or 9 MHz.

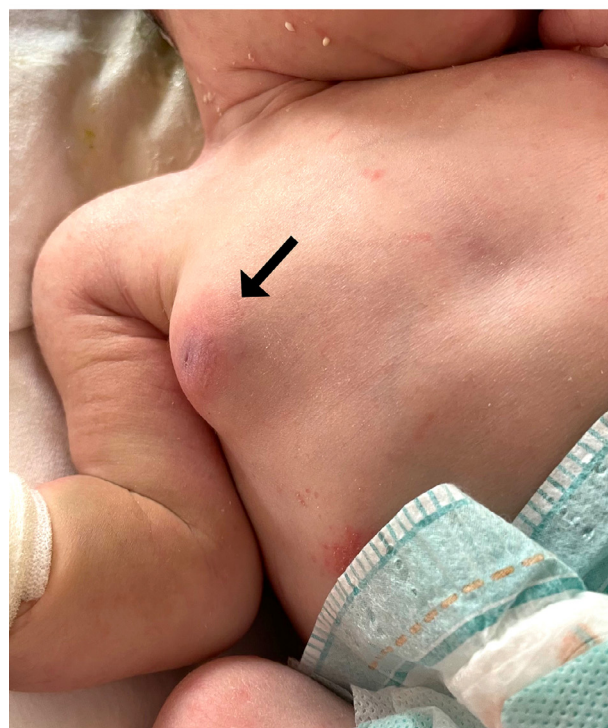
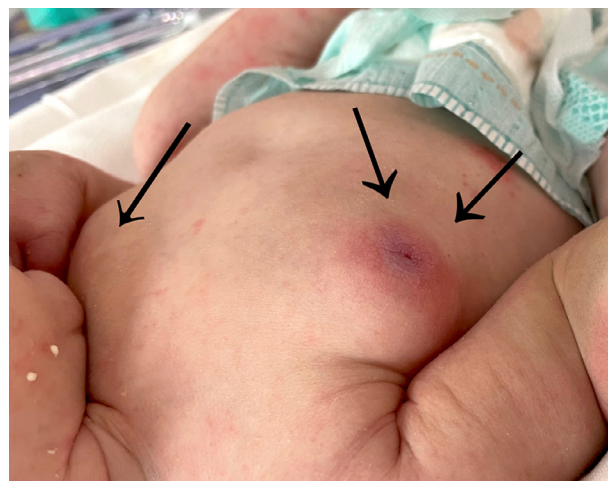
US of the neonatal breast showed classical features of neonatal breast enlargement: an ovoid-shaped mass located parallel to skin and well-distinct margins in the retroareolar region of both breasts that measured about $24 \times 24 \times 9$ mm and $26 \times 25 \times 10$ mm in diameter on the right and left side respectively (Fig. 3A–B).

The two of them were made up of a central heterogeneously hypoechoic tissue surrounded by numerous, mostly peripheral cysts of variable size (the bigger of 2.5 mm in the right breast) and with adjacent soft-tissue mild hyper-echogenicity. No debris, septations, inflammation signs or fluid-fluid levels were seen.

Color Doppler ultrasound of the masses showed the presence of some intralesional vascular poles with an orthogonal-to-cutaneous-plane oriented course and a retroareolar convergence (Fig. 4–5).

Both lesions were reducible to targeted compression.

Therefore, thanks to the US reassessment after clinical examination, a correct interpretation of the findings was given and the diagnosis of benign neonatal breast enlargement with adjacent cellulitis (or gynecomastia) was made. Pediatricians did not need for further examination for these patients: US was sufficient for diagnosis.



Figs. 1–2 – Clinical examination revealed enlarged breast tissue with no evidence of tenderness. There is an erythematous swelling (arrows)

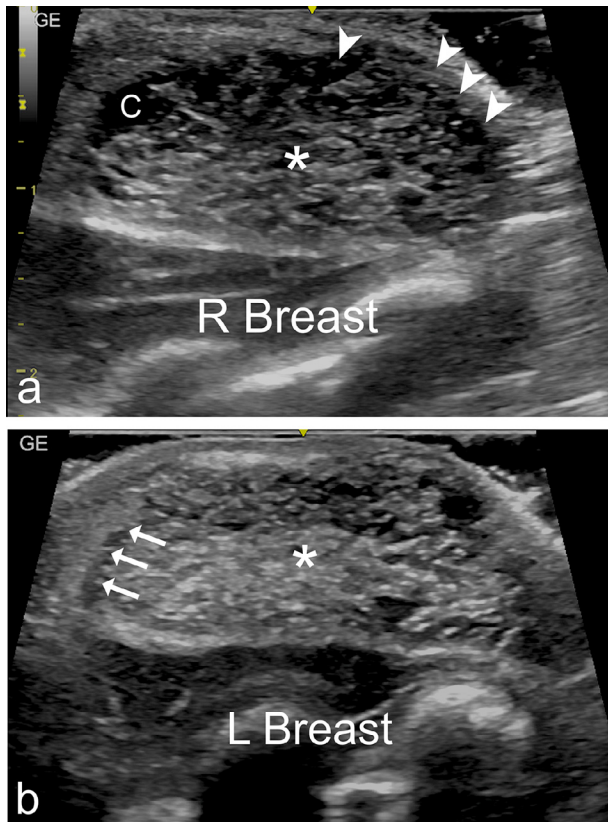


Fig. 3 – Ultrasound of right (A) and left (B) breast mass shows a well-defined (arrows), rounded, heterogeneously hypoechoic retroareolar mass (asterisks) with tiny peripheral cysts (arrowheads), the bigger of 2.5 mm in the right breast (letter C) and hyperechogenicity of surrounding subcutaneous soft-tissue

Follow up ultrasound of the breast performed after 14 days showed no significant regression of the abnormalities seen in the retroareolar regions.

Discussion

The embryology of normal breast development undergoes two stages of growth. The first stage occurs as early as 6 weeks of intrauterine life with the formation of a rudimentary breast tissue. The second occurs in adolescence and ended by the constitution of fully developed breast [3,4].

Neonatal breast enlargement is a benign condition of proliferation of glandular tissue. It is asymptomatic in 60%-90% of the cases and it affects both sexes with no predominance of gender. According to literature, it is caused by an exaggerated response to maternal oestrogen hormone crossing through the placenta into the fetal circulation or a normal response to dropping estrogen levels in the maternal circulation at the end of pregnancy, which results in a secretion of prolactin from the infant's pituitary gland [3-7].

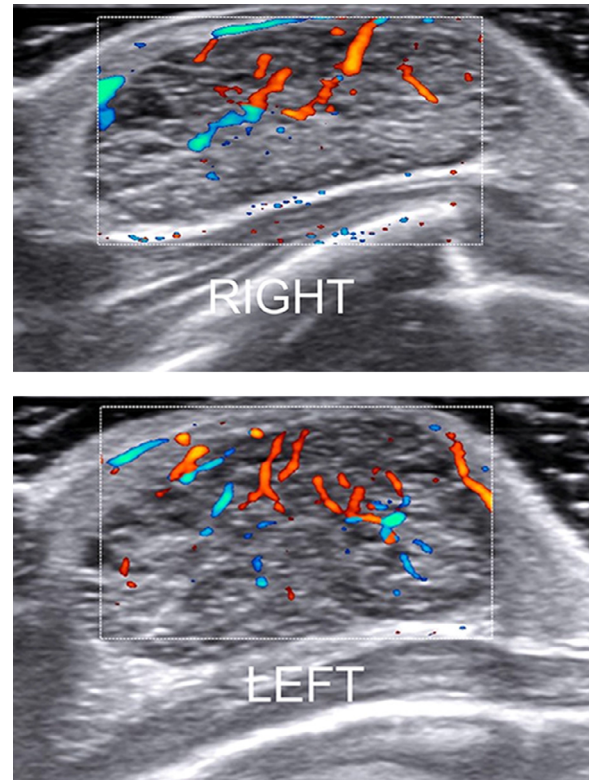


Fig. 4-5 – Color Doppler ultrasound of the right and left breast mass showed internal vascularity

It can be unilateral or bilateral, more frequently bilateral [6-8]. It's mostly reported in the 1st week of life and it is transient with a spontaneous reduction and resolution within 6 months of age or more in some babies. Sometimes, there is a discharge from enlarged breast, which may disappear with time without treatment [4-6]. This nipple secretion can be even bloody if caused by a recurrence of mammary duct ectasia. When the breast bud develops, it shows a retroareolar or subareolar hypoechoic tissue relative to the fat on US [3,8]. The classical sonographic features of neonatal breast hypertrophy include a hypoechoic retroareolar tissue or hyperechoic retroareolar nodule with central star-shaped or linear hypoechoic areas that represents simple branched ducts [3].

A different sonographic and clinical appearance is instead recognizable when a breast infection occurs, and in particular the distinction with neonatal mastitis should be always considered (Table 1).

Neonatal mastitis is an infection of the breast tissue, more common in full term infants due to the typical underdeveloped breasts of premature infants. It is found under 5 weeks of age with a maximum incidence at 3 weeks of age. It is mostly unilateral with no predilection for right or left breast. In the first 2 weeks of life, it is found in equal frequency in males and females, but after 2 weeks of life it is twice more likely in female infants. Staphylococcus aureus is the most common cause of neonatal mastitis with the 83%-88% of all cases. Potential etiology can vary and involve the colonization of the breast, nipple and mucous membranes skin by pathogens who enter through the nipple and then the breast ducts and

Table 1 – Differential diagnosis between enlargement of breast vs mastitis.

	Enlargement breast tissue	Mastitis
Peak incidence	1st week of life	2nd to 3rd week of life
Male: Female ratio	No predominance	1:2
Common local findings	No tenderness, Erythematous swelling, no purulent discharge or inflammation	Increasing tenderness, erythematous swelling, purulent discharge, fluctuation, skin rash, enlarged lymph nodes
Ultrasound with integration of echo-color Doppler	-heterogeneous well-defined hypoechoic breast tissue or hypoechoic retroareolar tissue or hyperechoic retroareolar nodule with central star-shaped or linear hypoechoic areas -minimal vascularization	-poorly marginated hyperechoic tissue -increased vascularization -in cases of abscess formation: avascular hyper or anechoic areas with surrounding hyperemia

reach the mammary gland which is engorged due to maternal hormones [7–9]. Anyway, if the pathogen is a gram-negative bacterium, a hematological spread may be observed. Children with a suspicion of mastitis require blood tests and nipple discharge culture and sensitivity for sepsis work-up, and then a sonographic assessment. Pharmacological treatment is the current therapy and parental antibiotics were usually prescribed with good coverage for *Staphylococcus aureus* [9]. Classical symptoms include swelling, tenderness, erythema, warmth, and induration with no systemic signs of infection [3]. Changes in the surrounding skin and the involvement of the axillary lymph nodes may also occur [10–11]. If mastitis is not cured, it can evolve to determine breast abscesses and rarely lead to cellulite, fascitis, osteomyelitis, cerebral abscess and generalized sepsis [7].

Borders *et al.* described the US appearance of neonatal mastitis as a mass with a mixed echogenicity and with internal vascularity or a not-well marginated hyperechoic hypervascular breast tissue. Surrounding hypervascular, there was hyperechoic subcutaneous fat. They suggested a differential diagnosis with neonatal breast abscess basing on the depiction of an increased blood flow surrounding a cystic breast mass. Breast abscess on the contrary prior showed a mixed echogenicity, then it appeared as an avascular hyperechoic mass [10–13].

In our case, US showed heterogeneously hypoechoic retroareolar mass with tiny cysts, internal vascularity and hyperechogenicity of the adjacent subcutaneous fat tissue, that allows a confident diagnosis of classical neonatal breast enlargement [12]. Clinically, differentiating neonatal breast hypertrophy from mastitis can be very critical as aggressive management with antibiotics and hospitalization depends on that [2,13]. Follow-up US after 3 months showed no significant reduction of size with no resolution of cystic changes in the asymptomatic breast masses, confirming the previous diagnosis. The breast symptoms of tenderness and discharge in our patient were therefore attributed to adjacent cellulitis and not neonatal mastitis for which this neonate was hospitalized and nearly treated with parenteral antibiotics.

In conclusion, we suggest, according to literature, that heterogeneously hypoechoic retroareolar masses with tiny cysts and internal vascularity should be regarded as common appearance of asymptomatic neonatal breast enlargement, not to be confused with neonatal mastitis, that show poorly

marginated tissue and a vivid vascularization [14,15]. Ultrasound assessment of symptomatic neonatal breast enlargement may aid to differentiate between this sonographic appearance of breast tissue accompanied by adjacent cellulitis from neonatal mastitis, in order to avoid an aggressive management with parenteral antibiotics and reduce hospitalization.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Data obtained in this study did not interfere with course of treatment for patients included.

Author contributions

All authors contributed equally to the manuscript and read and approved the final version of the manuscript. Authors' contributions.

Author Divina D'Auria has given substantial contributions to the conception or the design of the manuscript and participated to drafting the manuscript, author Dolores Ferrara and author Domenico Noviello to acquisition and interpretation of the data, author Nunzia Aragione, author Carolina De Chiara, author Ivan Noschese and author Gioconda Argenziano to analysis and interpretation of the clinical data. Author Francesco Esposito revised it critically.

All authors read and approved the final version of the manuscript.

Patient consent

Informed consent was obtained from all individual participants included in the study.

Availability of data and material

material and data are all available

Consent to participate

Additional consent to participate was obtained from all individual participants included in the study.

Consent for publication

Additional consent for publication was obtained from all individual participants included in the study.

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