

## CASE REPORT

### EVALUATION OF THE PUERPERAL BREAST THROUGH THERMOGRAPHY: A CASE REPORT\*

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#### ABSTRACT

**Objective:** to analyze puerperal breast temperature using infrared thermography.

**Method:** study performed at the Human Milk Bank of a Hospital in Curitiba, Brazil. A lactating mother with bilateral engorgement in the external breast quadrants was randomly selected and the temperature was measured.

**Results:** A soft mammary lobe was found, with thermal asymmetry of 1.5°C, compared to the contralateral region, however no thermal asymmetry was identified in the general temperature between the breasts.

**Conclusion:** this case suggests that thermal asymmetry in the puerperal breast is related to the volume of milk in the lobes and not to dysfunctions or pathologies in these lobes. The study indicates possibilities for deepening the understanding of lactational physiology with the amplification of the sample group evaluated in this study. Thermography is a technique suitable for lactating mothers, however requires an appropriate room, time for acclimatization and knowledge of the mammary anatomy.

**DESCRIPTORS:** Breast; Breastfeeding; Maternal and child nursing; Thermography; Lactation.

\*Article derived from the dissertation "A technological contribution for the management and evaluation of breast engorgement in lactation". Pontifical Catholic University of Paraná, 2011.

#### HOW TO REFERENCE THIS ARTICLE:

Santos Heberle AB dos, Nohama P, Pelloso SM. Evaluation of the puerperal breast through thermography: a case report. *Cogitare enferm.* [Internet]. 2019 [access "insert day, month and year"]; 24. Available at: <http://dx.doi.org/10.5380/ce.v24i0.57569>.



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## RELATO DE CASO / REPORTE DE CASO

### **EVIDÊNCIAS DA MAMA PUERPERAL POR TERMOGRAFIA: RELATO DE CASO**

#### **RESUMO**

*Objetivo: analisar a temperatura da mama puerperal utilizando termografia por infravermelho.*

*Método: estudo realizado no Banco de Leite Humano de um Hospital de Curitiba em 2011.*

*Selecionou-se aleatoriamente uma lactante com ingurgitamento bilateral nos quadrantes externos das mamas, e inspecionou-se a temperatura.*

*Resultados: encontrou-se um lobo mamário macio com assimetria térmica de 1,5°C, comparado à região contralateral, mas não se identificou assimetria térmica na temperatura geral entre as mamas.*

*Conclusão: este caso sugere que assimetria térmica na mama puerperal está relacionada ao volume de leite nos lóbulos e não a disfunções ou patologias nesses lóbulos. O estudo abre perspectivas para aprofundamento da compreensão da fisiologia lactacional com a ampliação do grupo amostral avaliado nesta pesquisa. A termografia é uma técnica adequada às lactantes, mas requer sala apropriada, tempo para aclimação e conhecimento da anatomia mamária.*

**DESCRITORES:** Mama; Aleitamento materno; Enfermagem materno-infantil; Termografia; Lactação.

### **EVIDENCIAS DE LA MAMA PUERPERAL POR TERMOGRAFÍA: INFORME DE CASO**

#### **RESUMEN**

*Objetivo: Analizar la temperatura de la mama puerperal utilizando termografía infrarroja.*

*Método: Estudio realizado en Banco de Leche Humana de hospital de Curitiba en 2011. Se seleccionó aleatoriamente una lactante con ingurgitación bilateral en cuadrantes externos de las mamas, y se verificó la temperatura.*

*Resultados: Se halló un lóbulo mamario blando con asimetría térmica de 1,5°C comparado con la zona contralateral, no identificándose asimetría térmica en temperatura general entre mamas.*

*Conclusión: Este caso sugiere que la asimetría térmica en la mama puerperal está relacionada con el volumen de leche en los lóbulos, y no con disfunciones o patologías en dichos lóbulos. El estudio ofrece perspectivas para profundizar la comprensión de la fisiología lactante, ampliando el grupo muestral evaluado en este estudio. La termografía es una técnica adecuada para las lactantes, aunque requiere de ámbito adecuado, tiempo de aclimatación y conocimiento de la anatomía mamaria.*

**DESCRIPTORES:** Mama; Lactancia Materna; Enfermería Materno infantil; Termografía; Lactancia.

## INTRODUCTION

Breastfeeding for the health of the child has been well studied and its benefits widely disseminated<sup>(1)</sup>, with it being advocated by the major world health organizations<sup>(2)</sup>. Its promotion is therefore considered a priority in public health<sup>(3)</sup>. However, this practice is impaired by the painful events that affect the puerperal breast, which can be avoided by means of an adequate approach with the lactating mother<sup>(4)</sup>. In a recent study, attention was drawn to the need for greater knowledge about the breast in order to implement care in the area of breastfeeding<sup>(5)</sup>.

Clinical examination and palpation of the breasts is still the most commonly used technique in the clinical practice<sup>(6)</sup>. The identification of breast problems in the puerperal period presents a challenge in medicine, due to the physiological changes. Considering the risks of methods that use ionizing radiation, ultrasound has been the method of choice for the inspection of breasts during the lactation period<sup>(7)</sup>. From this perspective, thermography appears as a non-invasive and non-radioactive diagnostic method, widely used in the industrial field, which has been used in the medical field. This method captures the infrared radiation emitted by a body and determines its temperature (T), obtaining images from absolute zero. Thus, different patterns of thermal distribution are observed, which provide information related to a certain process that is occurring in the body<sup>(4)</sup>.

In the clinical practice, nurses are professionals that play an important role with puerperal women, exerting a positive influence on the decision to breastfeed<sup>(8)</sup>. They also have the opportunity to contribute to research, in seeking evidence that may support their practice, considering the interventions in the events that affect the breast in lactation<sup>(4)</sup>. The aim of this study was to evaluate the thermal profile of the puerperal breast, through infrared thermography.

## METHOD

The study described was performed at the Human Milk Bank (HMB) of a University Hospital of Paraná. One lactating mother, with bilateral breast engorgement in the two external lateral quadrants of the breasts, remained in a room of 7.5m<sup>2</sup>, with temperature controlled at 23°C and relative humidity of 55%, monitored using a table thermo-hygrometer. There was insulation from heat sources.

In this study, two approaches were applied in the evaluation: clinical examination and infrared thermography. To obtain information regarding the breast temperature, a thermographic camera model A325, from FLIR Systems Inc, was used. The camera was placed on a 75cm high tripod, 130cm away from the subject. The image was obtained in the frontal position and, prior to image acquisition, the woman uncovered the chest region and remained for 15mins for acclimatization.

The physical examination was performed by a nurse with extensive experience in the management of breastfeeding. For a better understanding of the anatomy/physiology of the breast in lactation, the temperature was measured at points of interest, focusing on the differential color patterns and comparing this data with the physical examination performed after the images were obtained. The images were analyzed using the FLIR's ThermaCAM™ 2.9 software.

The study was approved by the Ethics Committee for Research with Human Subjects of the Pontifical Catholic University of Paraná, under authorization No. 5863.

## THE CASE

The lactating mother was 36 years of age, with brown skin, multiparous, this being her third pregnancy, and in the eighth day of puerperium, with the infant having been delivered at 34 weeks by cesarean section. Figure 1 shows the thermogram of the subject with hypertrophic breasts, protruding, intact nipples, and bilateral engorgement in the external lateral quadrants. The child was in the neonatal Intensive Care Unit (ICU), receiving milk from its own mother, and had been breastfed for the first time on the left breast (E), 30 min before the images were acquired. The yellow color area (SP14) in this breast was soft, and a negative temperature gradient occurred when compared to other regions of the same breast, denoting thermal asymmetry (difference  $\geq 0.3^{\circ}\text{C}$ ) within it. The internal lateral temperature (LI) of this breast was higher than the external temperature (LE).

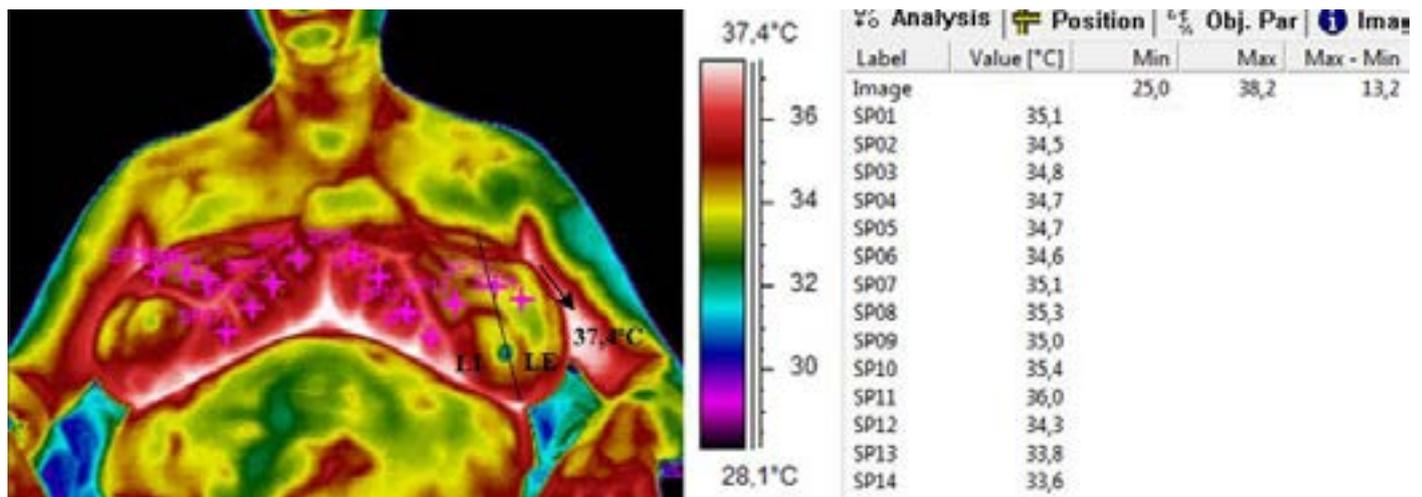


Figure 1 - Thermogram of lactating mother with lobar engorgement, from the Flying Spotmeter marker (Hainhi palette). Curitiba, PR, Brazil, 2011.

Comparing the right breast (D), at points SP01 to SP07, with the left breast (E), at points SP08 to SP14, D presented a mean temperature of  $34.8^{\circ}\text{C}$  and E a mean of  $34.7^{\circ}\text{C}$ , with no thermal asymmetry between them. However, a qualitative difference was observed in the thermal distribution pattern, with a homogeneously distributed temperature pattern being observed throughout D. When the SP01 and SP014 contralateral regions were compared, thermal asymmetry was identified: the external quadrant of the breast was softer and had a negative gradient of  $1.5^{\circ}\text{C}$ . According to the subject, this region of the breast had softened during the breastfeeding performed 30mins before the image acquisition. In the axillary region (arrow) and inframammary crease, the temperature was higher than in the breasts. Figure 1 shows Haller's anastomotic network (light pink), formed by calibrous veins that cover a large part of the breast surface.

## DISCUSSION

For this study, safety and comfort were indispensable criteria for obtaining the image. Thus, thermography was considered a suitable method to study the thermodynamic and circulatory alterations of the breast during the lactation period. In the puerperal period, the breast undergoes various changes<sup>(7)</sup>. In the postpartum period, the breast becomes engorged, lymphatic and venous stasis may occur, with increased vascularization and the production of milk<sup>(9)</sup>. Physiological changes of the body have also been detected in other studies that used thermography<sup>(10-11)</sup>, which has been confirmed as a method of physiological analysis.

The thermal asymmetry found was related to the degree of softness of the mammary lobe, with the image examination being supported by a physical examination. Thermography identifies thermal and vascular anomalies<sup>(11)</sup>, providing data on changes in blood flow, however, does not provide information on the anatomical structures of deep body parts<sup>(10)</sup>. The temperature of the skin of the healthy human body exhibits thermal symmetry. Thus, a temperature above 0.5°C is considered asymmetrical, indicating the existence of painful processes or diseases<sup>(11)</sup>, however, according to the literature, only thermal asymmetries greater than 1.0°C indicate the existence of pathological processes<sup>(10)</sup>.

In the present study, Haller's vascular network and its anastomoses were visualized as a mesh on the surface of the breasts, limiting the analysis of the images. In the past, methods such as mammography and ultrasound have also shown limitations due to the mammary gland density and the volume of milk inside the breast. However, with technological advances, ultrasound images produce better resolution, allowing the visualization of very small structures inside the breast<sup>(12)</sup> and identifying the milk flow and the dilatation of the ducts<sup>(13)</sup>. However, the disadvantages of this method include the impossibility of an overall visualization of the breast and the need for an experienced operator<sup>(7)</sup>.

Among the advantages of thermography in this study are its easy implementation, sensitivity, thermal (0.08°C) and spatial resolution (0.1mm), image quality, immediate results, innocuity, the possibility of multiple repetitions, static and dynamic analysis, comfort for the patient, and the fact that contact with the body of the subject is not required. The limitations, in addition to Haller's network, include the prolonged time for body acclimatization and the impossibility of a complete view of the breast when in 2-D, similar to the ultrasound method. Hypertrophic mammals usually present ptosis, and the lactating woman in a sitting position did not allow a general visualization of the breast. Thus, the lower quadrants and the outer sides were not visualized. Performing the examination with the raised arms would be inadequate as, considering the time for acclimatization of the breasts, the subject needs to be in a comfortable position. This situation has also been found in other methods of breast assessment.

In another study involving thermal evaluation, the authors used the Thermofocus®, which measures temperature without contact with the subject's body. It is a thermometer that measures the temperature in a particular region of interest of the breasts<sup>(14)</sup>. Thus, obtaining the temperature without physical contact represents one of the advantages of this instrument, similar to thermography. However, its disadvantage is to measure the temperature at a point, while thermography allows the acquisition of images, thermally mapping the entire surface of the mammary gland evaluated.

Similar to thermography<sup>(15)</sup>, several other imaging methods have been applied in mammary evaluation, such as mammography, ultrasound, magnetic resonance imaging (MRI) and scintigraphy. Each of these methods presents advantages and disadvantages in relation to the others. From this perspective, new techniques are emerging to meet the current demands, especially in the identification of breast lesions, with nuclear magnetic resonance being a possibility, however, its best clinical application has not yet been established<sup>(16)</sup>. Currently, ultrasound is considered to present the best performance. Therefore, it is the first choice method for breast examinations, providing good results with relatively complex handling. It plays an important role as a complementary mammography examination, however, requires knowledge of anatomy and mammary pathologies. For these reasons, the ultrasound examination is considered operator dependent. It is especially indicated for pregnancy and lactation<sup>(17)</sup>. For the present study, ultrasound was the technique initially considered as an investigation methodology. However, it was unfeasible due to lack of technical resources and availability of professionals with expertise in the area. Thus, thermography was adopted as a suitable experimental method for infants as it was considered by other authors<sup>(15)</sup> to be comfortable, painless and free of radiation (ionizing or not).

## CONCLUSION

In this study, it was verified that the physical examination, considered the gold standard, can be supported by the technology used experimentally in this study. Thermography provided evidence regarding the physiology of the puerperal breast, suggesting that breast emptying may decrease glandular tension and temperature, providing relief and comfort for the subject. The thermal asymmetry in the puerperal breast may not represent anomalies or pathologies, but may be related to the volume of milk inside the lobes. By not employing ionizing radiation, this technique is suitable for lactating women. However, it requires an appropriate room, time for acclimatization and knowledge of breast anatomy.

## ACKNOWLEDGMENTS

The authors thank SETI-PR for the financial support for the acquisition of the thermographic camera (028/05) and CNPq for the research productivity grant (309514/2014-2).

## REFERENCES

1. Pinto E, Chaves C, Duarte J, Nelas P, Coutinho E. Maternal affection and motivation for breastfeeding. *Procedia Soc Behav Sci*. [Internet]. 2016 [acesso em 07 abr 2018]; 217. Disponível em: <https://doi.org/10.1016/j.sbspro.2016.02.099>.
2. Rodrigues JM, Lima PJ de. Contribuição científica sobre o aleitamento materno nos anos 1990 a 2014. *Cad. Saúde Desenv*. [Internet]. 2016 [acesso em 07 abr 2018]; 3(2). Disponível em: <https://www.uninter.com/cadernosuninter/index.php/saude-e-desenvolvimento/article/view/414>.
3. Galvão DM, Cardoso C. da M. Enfermeiros especialistas em enfermagem de saúde infantil e pediatria e promoção da amamentação após o regresso ao trabalho. *Int J Educ Dev. Revista INFAD de Psicología*. [Internet]. 2017 [acesso em 07 de abr 2018]; 3(1). Disponível em: <http://dx.doi.org/10.17060/ijodaep.2017.n1.v3.1020>.
4. Heberle ABS, Pelloso SM, Nohama P. Puerperal Breast Engorgement: A Technological Intervention. *Nurs.Care Open Access Journal*. [Internet]. 2017 [acesso em 07 de abr 2018]; 3(6). Disponível em: <http://dx.doi.org/10.15406/ncoaj.2017.03.00093>.
5. Mangesi L, Zakarija-Grkovic I. Treatments for breast engorgement during lactation. *Cochrane Database Syst Rev* [Internet]. 2016 [acesso em 07 de abr 2018]; 6(28). Disponível em: <http://dx.doi.org/10.1002/14651858.CD006946.pub3>.
6. Heberle ABS, Ichisato SMT, Nohama P. Breast evaluation during lactation using thermography and pressure algometry. *Acta paul. enferm*. [Internet]. 2015 [acesso em 07 abr 2018]; 28(3). Disponível em: <http://dx.doi.org/10.1590/1982-0194201500043>.
7. Holanda AAR de, Gonçalves AKS, Medeiros RD, Oliveira AMG de, Maranhão TMO. Ultrasound findings of the physiological changes and most common breast diseases during pregnancy and lactation. *Radiol Bras*. [Internet]. 2016 [acesso em 07 abr 2018]; 49(6). Disponível em: <http://dx.doi.org/10.1590/0100-3984.2015.0076>.
8. Miranda LM, Zangão OB, Riso S. O papel do enfermeiro no sucesso para o aleitamento materno: revisão da literatura nurse's role in success for breastfeeding: review of literature. *RIASE* [Internet]. 2017 [acesso em 07 de 2018]; 3(1). Disponível em: [http://dx.doi.org/10.24902/r.riase.2017.3\(1\).854](http://dx.doi.org/10.24902/r.riase.2017.3(1).854).
9. Heberle ABS, Moura MAM de, Souza MA de, Nohama P. Avaliação das técnicas de massagem e ordenha no tratamento do ingurgitamento mamário por termografia. *Rev. Latino-Am. Enfermagem* [Internet]. 2014 [acesso em 07 de abr 2018]; 22(2). Disponível em: <http://dx.doi.org/10.1590/0104-1169.3238.2413>.
10. Côte AC, Hernandez AJ. Application of medical infrared thermography to sports medicine. *Rev*

Bras Med Esporte. [Internet]. 2016 [acesso em 07 de abr 2018]; 22(4). Disponível em: <http://dx.doi.org/10.1590/1517-869220162204160783>.

11. Kwak BK, Jang EC, Shim HJ, Song KS. Asymmetric Thermal Response of Human Feet to Hopping Detected by Digital Infrared Imaging. Br J Med Med Res [Internet]. 2015 [acesso em 07 de abr 2018]; 6(11). Disponível em: <http://dx.doi.org/10.9734/BJMMR/2015/15073>.

12. Ramsay DT, Kent JC, Hartmann RA, Hartmann PE. Anatomy of the lactating human breast redefined with ultrasound imaging. J anot. [Internet]. 2005 [acesso em 07 de abr 2018]; 206(6). Disponível em: <https://doi.org/10.1111/j.1469-7580.2005.00417.x>.

13. Geddes DT. Ultrasound imaging of the lactating breast. Methodology and application. Int Breastfeed J [Internet]. 2009 [acesso em 07 de abr 2018]; 4(4). Disponível em: <https://doi.org/10.1186/1746-4358-4-4>.

14. Lim AR, Song JA, Hur MH, Lee MK, Lee MS. Cabbage compression early breast care on breast engorgement in primiparous women after cesarean birth: A controlled clinical trial. Int J Clin Exp Med [Internet]. 2015 [acesso em 07 de abr 2018]; 8(11). Disponível em: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4723919/>.

15. Rassiwala M, Mathur P, Mathur R, Farid K, Shukla S, Gupta PK, Jain B. Evaluation of digital infrared thermal imaging as an adjunctive screening method for breast carcinoma: A pilot study. Int J Surg. [Internet]. 2014 [acesso em 08 de abr 2018]; 12(12). Disponível em: <https://doi.org/10.1016/j.ijssu.2014.10.010>.

16. Barra FR, Barra RR, Barra SA. Novos métodos funcionais na avaliação de lesões mamárias. Radiol Bras. [Internet]. 2012 [acesso em 08 abr 2018]; 45(6). Disponível em: <http://dx.doi.org/10.1590/S0100-39842012000600010>.

Received: 02/02/2018

Finalized: 14/02/2019

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Final approval of the version to be published - ABSH, PN, SMP