Original Article

Unusual findings on MRI of patients with breast implants

Achados incomuns em ressonância magnética de pacientes com implantes mamários

IGOR MOURA SOARES[1]*
MARCELA CAETANO CAMMAROTA[1]
ROSIMARA EVA FERREIRA ALMEIDA CAMELO[1]
SAULO FRANCISCO DE ASSIS GOMES[1]
MARCELA SANTOS VILELA[1]
JOSÉ CARLOS DAHER[1]

■ **ABSTRACT**

Introduction: Breast prosthesis implantation is one of the most performed surgeries in the world. Over time, different materials were used to reconstitute breast volume. Despite technical and surgical improvements and the safety of current implants, patients are faced with potential "unusual" complications: intracapsular and extracapsular ruptures, late hematomas and contour deformity, intra-nodal silicone, or herniation of the fibrous capsule. Magnetic resonance imaging (MRI) is the most useful imaging modality for investigating these complications. **Method:** This is a series of cases in which so-called "unusual" changes were reported, due to their low frequency or lack of mention in the literature, after surgeries to include a silicone prosthesis. The data were collected from the personal experience of one of the authors in his private clinic, in the city of Brasília-DF, between April 2015 and March 2023. **Results:** A total of 211 patients were evaluated, and less frequent changes were found in the MRI of 12 patients (5.68%), of which: 5 with a large amount of pericapsular fluid, 3 with capsular granuloma, 1 late seroma with hemorrhagic content, 1 intra and extracapsular rupture, 1 nodule close to the implant's fibrous capsule, 2 axillary lymph node disease ipsilateral, 1 intra-nodal silicone, 1 pectoral muscle edema, 2 desmoid tumor and 1 herniation of the fibrous capsule. **Conclusion:** It is estimated that there are 50 million women with breast implants in the world. Based on this data, the number of so-called "unusual" complications becomes a diagnostic challenge for the plastic surgeon and radiologist.

Keywords: Incidental findings; Breast; Magnetic resonance imaging; Silicone elastomers; Breast implants.

■ **RESUMO**

Introdução: O implante de prótese mamárias é uma das cirurgias mais realizadas no mundo. Ao longo do tempo, diversos materiais foram utilizados com objetivo de reconstituir o volume mamário. Apesar das melhorias técnicas, cirúrgicas e da segurança dos implantes atuais, os pacientes são confrontados com potenciais complicações "não usuais": rupturas intracapsulares e extracapsulares, hematomas tardios e deformidade de contorno, silicone intralinfonodal ou herniação da cápsula fibrosa. A ressonância magnética (RMN) é a modalidade de imagem mais útil para investigação dessas complicações. **Método:** Trata-se de uma série de casos em que foram levantadas alterações ditas "não usuais", pela baixa frequência ou ausência na citação da literatura, após cirurgias de inclusão de prótese de silicone. Os dados foram coletados da experiência pessoal da clínica privada de um dos autores, na cidade de Brasília-DF, entre abril de 2015 e março de 2023. **Resultados:** Foram um total de 211 pacientes avaliados, e foram encontradas alterações menos frequentes nas RMN de 12 pacientes (5,68%), das quais: 5 com volumosa quantidade de líquido pericapsular, 3 com granuloma capsular, 1 seroma tardio com conteúdo hemorrágico,1 rotura intra e extracapsular, 1 nódulo junto à cápsula fibrosa do implante, 2 linfonodopatia axilar ipsilateral, 1 silicone intralinfonodal,

Institution: Hospital Daher Lago Sul, Brasília, DF, Brazil.

Article received: January 19, 2024.
Article accepted: February 4, 2024.

Conflicts of interest: none.

DOI: 10.5935/2177-1235.2024RBCP0922-EN

[1] Hospital Daher Lago Sul, Brasília, DF, Brazil.

1 edema do músculo peitoral, 2 tumor desmoide e 1 herniação da cápsula fibrosa. **Conclusão:** Estima-se que existam 50 milhões de mulheres com próteses de mama no mundo. Com base nesse dado, o número de complicações ditas "não usuais" passa a ser um desafio diagnóstico para o cirurgião plástico e o radiologista.

Descritores: Achados incidentais; Mama; Imageamento por ressonância magnética; Elastômeros de silicone; Implantes de mama.

INTRODUCTION

The breasts are of fundamental importance in the patient's psychosexual well-being, since the desire to improve aesthetic appearance is part of self-care, whether to reverse sagging, increase volume, rejuvenate, correct asymmetry, or reconstruct the breasts[1]. Thus, the implantation of breast prostheses is one of the most performed surgeries in the world, according to data released by the International Society of Aesthetic Plastic Surgery (ISAPS), representing around 15.8% of aesthetic surgical interventions carried out in 2018, worldwide[2].

In 1889, Gersuny described breast augmentation with paraffin injection into the breast parenchyma. Over time, various materials have been used to reconstitute breast volume, such as ivory prostheses, sponges of different compositions, dermal-fat grafts, liquid silicone, or gel[3].

The introduction of silicone breast implants began in 1963, in the United States of America, through Cronin and Gerow, and since then the aforementioned surgical intervention has been the subject of great discussion[4,5]. The initial conception aimed at aesthetic surgeries, but currently the field of breast reconstruction uses implants on a large scale[6]. The first implants were manufactured with thick elastomer, in two halves, which were glued together to form a single piece. Over time, several evolutionary steps were overcome[7,8].

Sperli described 7 evolutionary phases of breast implants that depend on the type of wrap, with or without patch, coating, and inflatable prostheses[9,10]. For most types of implants and styles, there have been variations over the years, with single-lumen gel-filled implants being more common in our country[6].

Despite improvements in surgical techniques and the safety of current implants, patients are still faced with potential complications, the most frequently encountered of which are hematomas, seromas, infections, asymmetries, rippling, and especially capsular contractures, which are still the most commonly seen complications. with a global incidence of around 27%, associated with the use of smooth and textured implants from the first generations of prostheses[11-13].

Although mammography and ultrasound are the exams initially requested for investigation, nuclear magnetic resonance (NMR) is the most useful imaging modality for characterizing breast implants, due to its high spatial resolution and the provision of a contrast image between the implant and surrounding soft tissues[14]. Another advantage is the absence of ionizing radiation. NMR has greater sensitivity (72-94%) and specificity (85-100%) to detect implant ruptures, thanks to its sequences that can suppress or emphasize the signal from the silicone[3].

In the MRI protocol, high-resolution devices, the internal composition of the silicone is better visualized with details in a sagittal T2 FSE (Fast spin echo) image, and the high-quality T2 image with water suppression can be useful to differentiate the silicone with intracapsular rupture from the peri-implant fluid[15]. Two-plane imaging is indicated to differentiate early intracapsular ruptures from folds formed at the bottom and top of the implant. Furthermore, imaging in the anteroposterior plane is not recommended due to artifacts caused by the heart and chest[15].

Unusual complications may occur, such as intracapsular and extracapsular ruptures, late hematomas, and contour deformities, with magnetic resonance imaging being the gold standard image evaluation for diagnostic elucidation[16].

Seromas are uncommon late complications, but can occur without a defined cause, the treatment of which involves the removal or replacement of prostheses[17]. The appearance of a large seroma more than one year after implant placement is defined as late. In prospective studies, it was estimated that breast implant-related anaplastic large cell lymphoma (BIA-ALCL) is common in late seroma presentations[18]. In the event of a late seroma that is not easily explained by infection or trauma, the disease should be considered suspected[19].

The most common type of rupture is that of the implant shell (elastomer envelope)[20], the leak of which does not extend beyond the fibrous capsule that commonly forms around silicone implants, accounting for 80 to 90% of all intracapsular implant ruptures [5]. Extracapsular rupture is defined as the extrusion of

both the shell and the fibrous capsule, with macroscopic silicone leakage[21-23].

OBJECTIVE

To survey the changes found in MRI scans of patients with silicone implants, and identify unusual findings and their frequencies in a large radiology service.

METHOD

A retrospective survey was carried out in the registry of a private radiology clinic in Brasília-DF of exams carried out on patients with silicone implants between April 2015 and March 2023.

This is a series of cases in which patients with alterations were identified and the so-called "unusual" alterations were selected, due to their low frequency or absence of citation in the literature, after surgeries to include a silicone prosthesis. Patients who underwent breast augmentation using implants for aesthetic purposes or breast reconstruction were included in the study.

The reason for carrying out the exam was not the subject of the study. A survey of nuclear magnetic resonance (NMR) reports and images was carried out and those that showed unusual findings were selected for study. Furthermore, a literature review was carried out on each of the cases described and listed below.

Finally, it should be noted that the present study followed the principles contained in the Declaration of Helsinki, developed by the World Medical Association. Furthermore, the work was submitted and approved by the Ethics and Research Committee, under number 75934023.7.0000.0257.

RESULTS

211 patients with breast implants underwent MRI and changes were found in 12, which corresponds to 5.68% of the total. A classification into 3 groups was used:

Group 1, with a total of 5 patients: 5 patients (2.3%) presented a large amount of pericapsular fluid, 3 of which were cases of pericapsular seroma, submitted to aspiration punctures and CD30 and ALK1 measurement, considering the possibility of IABP -ACL, with 1 positive patient. Others 3 patients (1.4%) had capsular granuloma and 1 patient (0.4%) had late capsular seroma with hemorrhagic content.

Group 2, with a total of 3 patients: 2 patients (0.9%) had axillary lymph node disease; 1 patient (0.4%) had intra and extracapsular rupture; 1 patient (0.4%) had a nodule close to the fibrous capsule of the implant; 1 patient (0.4%) ipsilateral axillary lymph node disease of probable inflammatory/infectious origin and 1 patient (0.4%) intra-nodal silicone.

Group 3, with a total of 4 patients: 1 patient (0.4%) with pectoral muscle edema, 2 patients with desmoid tumor, and 1 patient (0.4%) with herniation of the fibrous capsule.

Case 1

B.A.L.I., female, 25 years old, states that 5 years ago she underwent surgery to place a prosthesis for aesthetic purposes for breast augmentation. She underwent surgery with the apposition of implants in the retroglandular plane. Radiological finding: bilateral pericapsular fluid, in greater quantity on the right, associated with enhancement of the fibrous capsule. Given the possibility of BIA-A.L.C.L., the investigation continued with ultrasound-guided needle aspiration, yielding a positive result.

Case 2

D.G., female, 69 years old, reports that she underwent breast reconstruction surgery after a bilateral mastectomy with silicone implants in the retromuscular plane. An MRI examination was performed with the finding of a large pericapsular seroma on the right, suspicious for BIA-ALCL, a capsular nodular image with heterogeneous enhancement, but probably corresponding to an induced silicone capsular granuloma. Furthermore, there was a morphological change in the right prosthesis compatible with capsular contracture.

Case 3

R.C.M., female, 71 years old, 22 years ago she underwent aesthetic breast surgery with a silicone implant in the retroglandular plane. A routine examination revealed a large pericapsular seroma with hyperproteic/hemorrhagic content on the right. FNAB was performed, considering the possibility of BIA-ALCL. After this MRI examination, this patient underwent bilateral capsulectomy surgery, with clot removal on the right and breast reconstruction 1 year ago.

Case 4

J.M., female, 62 years old, states that 6 years ago she underwent breast augmentation surgery with implants placed in the retroglandular plane. MRI

revealed a nodule next to the fibrous capsule of the left implant of non-specific origin, which may correspond to a granuloma.

Case 5

K.A., female, 55 years old, undergoing reconstruction surgery due to a right mastectomy. An MRI performed revealed enhancement of the breast parenchyma and implant capsule on the left, associated with non-specific ipsilateral axillary lymph node disease, probably inflammatory/infectious.

Case 6

R.C.S., 66 years old, states that 11 years ago she underwent cosmetic surgery for breast augmentation with a retroglandular silicone prosthesis. MRI showed that the left implant showed signs of capsular contracture. Absence of signs suggestive of intra and extracapsular rupture of the implants.

Case 7

A.S., 46 years old, female, underwent aesthetic silicone breast implant surgery in the retroglandular position 10 years ago. Presents silicone in the right breast with a moderate amount of pericapsular fluid, in addition to thickening and diffuse enhancement of the fibrous capsule.

Case 8

C.A.M., 52 years old, female, underwent breast reconstruction surgery due to bilateral adenomastectomy using double lumen breast expanders, with signs suggestive of intracapsular rupture on the left. In addition, on imaging exams, left axillary lymph node enlargement is presented, with a heterogeneous signal, which may correspond to intra-nodal silicone, suggesting ipsilateral extracapsular rupture.

Case 9

E.R., 49 years old, female, underwent cosmetic surgery 2 years ago with a breast implant in the retroglandular plane. Imaging examinations showed marked thickening and diffuse pericapsular enhancement, associated with morphological changes, a large pericapsular seroma, and edema of the underlying pectoral muscle, with pre-sternal extension to the medial aspect of the fibrous capsule and contralateral pectoral muscle.

Case 10

C.M., 47 years old, female, underwent breast reconstruction surgery with prosthesis in the submuscular plane. On magnetic resonance imaging of the breasts, a breast expander on the right of the usual shape, without signs of rupture, with diffuse capsular enhancement. In the inferolateral quadrant of the right breast, there is a herniation of the fibrous capsule with heterogeneous contents.

Case 11

B.K.A., 30 years old, female, underwent mammoplasty with the inclusion of implants, for aesthetic purposes. One year after surgery, a hardened area was noticed in the left breast. Magnetic resonance imaging was performed, finding a heterogeneous nodulation in close contact with the implant capsule, with a positive result for desmoid tumor.

Case 12

L.M.F., 54 years old, female, underwent aesthetic surgery with an implant in the retroglandular plane. She reported nodulation in the left breast, which presented an irregular and spiculated appearance on MRI, with a result compatible with a desmoid tumor.

DISCUSSION

Faced with several complications related to breast implants, magnetic resonance imaging is the method of choice for evaluating the integrity of silicone implants, as it is more accurate than mammography and ultrasound, chosen for monitoring and cancer screening[6]. With a sensitivity of up to 94% in detecting rupture and specificity between 85% and 100%, sequences with and without silicone suppression are used, as well as combined sequences to evaluate parenchyma and prosthesis[24].

In the evaluation of lesions in the breast parenchyma, paramagnetic contrast can be used, which has better accuracy in recent post-operative breasts, due to the architectural distortion and edema of the operated breast[24]. This usual change is seen when capsular contracture occurs, after breast augmentation with silicone. The thin fibrous capsule normally forms around the prosthesis and causes discomfort and deformity in the breast architecture[15].

There are several signs found on MRI that correspond to complications of silicone implants, with findings compatible with extracapsular rupture

(keyhole sign or noix sign) being described in the literature[6]. Furthermore, on the sagittal-weighted image, the subcapsular line signal corresponds to the intracapsular tear. This sign is known as salad oil (foci of hypersignal on T2 inside the prosthesis)[24].

Two patients presented intracapsular rupture, as shown in Figure 8C, which depicts the linguine sign, and the presence of several hypointense curvilinear lines within the silicone gel.

The radiological sign of capsular contracture shown in Figures 1C and 2D can be analyzed as an increase in the anteroposterior diameter of the implant, associated with its asymmetry and rounded shape[8].

Large late seromas were found in group 1 and are exemplified in Figures 1A, 1B, 2A, and 3C. In the literature, possible etiological assumptions point to rupture of the prosthesis, which did not occur in any case[25]. However, in prospective studies, it was estimated that BIA-ALCL occurs in 9 to 13% of late

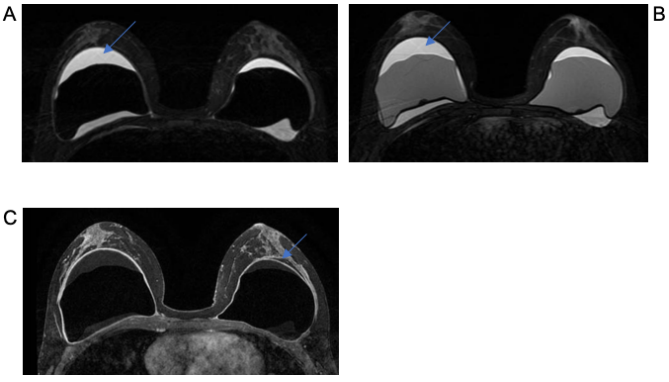

Figure 1. A and B. Axial T2 sequences show a large bilateral pericapsular seroma, slightly larger on the right. C. Post-contrast T1 sequence in axial plane showing slight thickening and enhancement of the fibrous capsule (arrows).

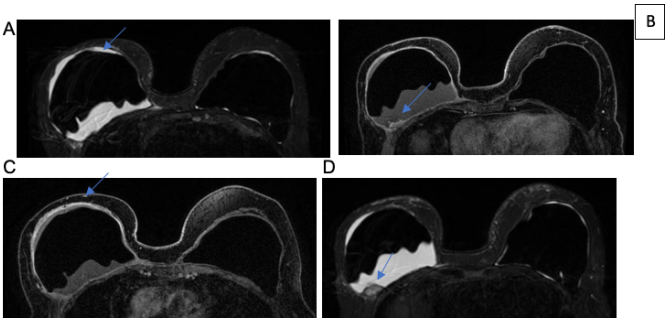

Figure 2. A. Axial T2 sequence showing a large pericapsular seroma on the right, slightly hyperproteic. B and C. Post-contrast T1 (B) and T2 (C) sequences in the axial plane show hyperintense capsular nodular image on T2 and with heterogeneous and persistent enhancement on the posterior aspect of the right implant, suggestive of induced silicone capsular granuloma (arrows). D. Post-contrast T1 sequence in axial plane showing changes in the morphology of the right implant, with a reduction in lobulations associated with thickening and diffuse and irregular pericapsular enhancement, suggestive of capsular contracture.

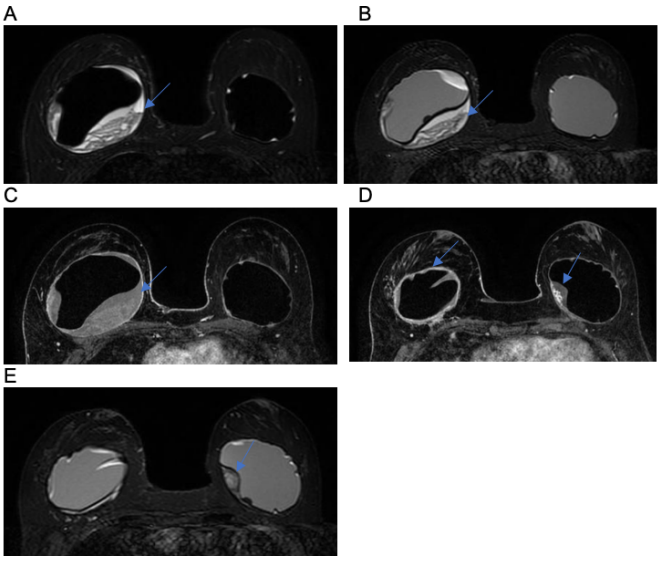

Figure 3. A, B, and C. Post-contrast T2 (A and B) and T1 (C) sequences in the axial plane show a large heterogeneous hyperproteic pericapsular seroma on the right and diffuse pericapsular thickening and enhancement. D and E. Post-contrast T1 (D) and T2 (E) sequences in the axial plane showing hyperintense capsular nodular image on T2 and with heterogeneous and persistent enhancement in the left implant, suggestive of induced silicone capsular granuloma (arrow).

seroma presentations[17]. But this fact could be justified by other causes, such as, for example, friction between the prosthesis and the organic pocket, the chronic inflammatory process, and metaplasia of the internal surface of the capsule[10].

Pinchuk & Tymofii[26], in a series of 569 patients who had breast implants, reported 6 cases of late seroma, occurring between 2 years and 10 years postoperatively. In the authors' opinion, the friction of the prosthesis against the internal surface of the organic capsule was one of the main reasons for synovial metaplasia on this surface, but also chronic infection and the consequent formation of seroma.

Lymphatic drainage of the breast occurs mainly via 3 routes: supraclavicular, axillary, and internal mammary, justifying the local lymphadenopathy in cases of prosthesis rupture[27], similar to what occurred in case 8 and demonstrated in Figure 8D. Silicone lymphadenopathy is an unusual finding on MRI and has a poorly understood mechanism. However, it is believed that silicone particles are transported to lymph nodes via macrophages in the reticuloendothelial system. In these cases, the diagnosis of breast cancer must be excluded[25].

Unlike rupture, silicone gel leakage is microscopic through an intact implant shell. This phenomenon is related to the chemical affinity between the outer layer of the silicone elastomer and the gel contained

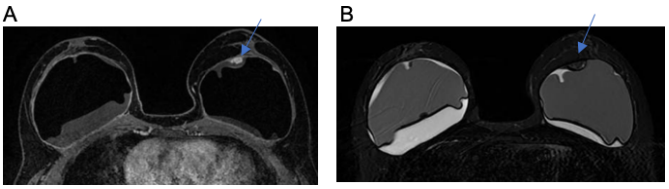

Figure 4. A and B. Post-contrast T1 (A) and T2 (B) sequences in the axial plane showing hyperintense capsular nodular image on T2 and with heterogeneous and persistent enhancement on the left implant, suggestive of induced silicone capsular granuloma (arrow).

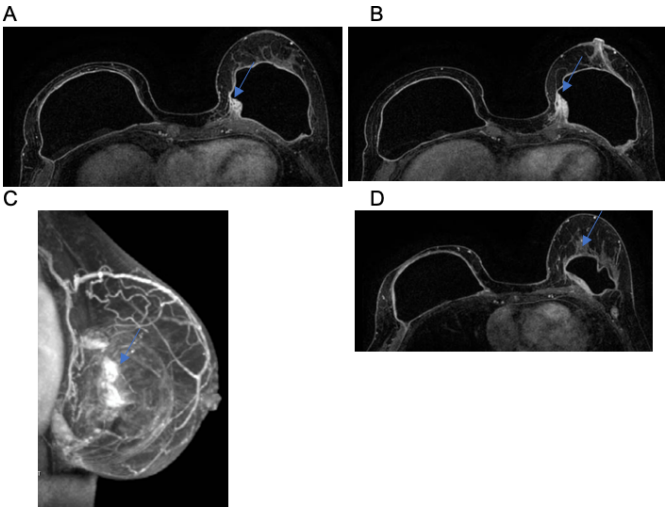

Figure 5. A, B, and C. Post-contrast T1 sequences in the axial plane showing enhancement of the breast parenchyma in the posterior third of the medial quadrants of the left breast, next to the breast implant, associated with enhancement of the fibrous capsule and local skin thickening and enhancement. D. 3D MIP reconstruction (maximum intensity projection) in the sagittal plane demonstrating these findings.

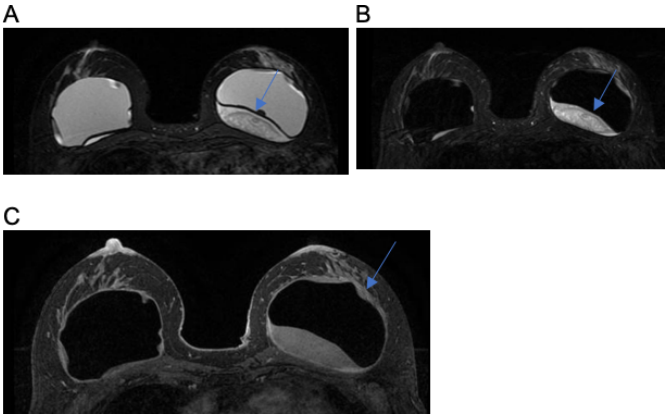

Figure 6. A and B. Axial T2 sequences showing heterogeneous pericapsular seroma on the left (arrows), in addition to reduced lobulations of this implant. C. Post-contrast T1 sequences in the axial plane showing thickening and diffuse enhancement of the fibrous capsule of the left implant (arrow).

therein[14]. Contact with the outer shell can disrupt non-covalent molecular bonds between polymer chains, causing swelling and weakening of the shell itself. Once separated from its envelope, the silicone can migrate, reaching the upper limbs, inguinal lymph nodes, and

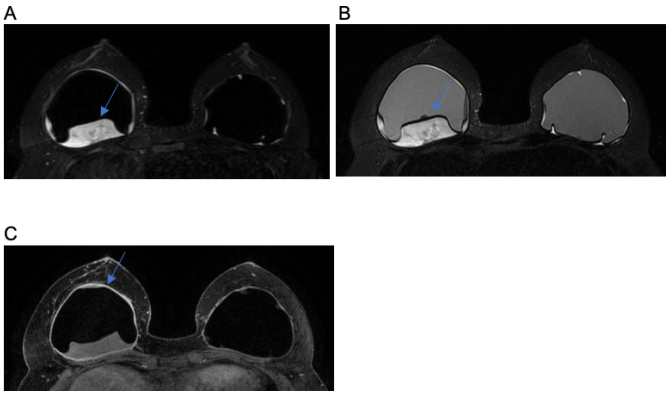

Figure 7. A and B. Axial T2 sequences showing heterogeneous pericapsular seroma on the right (arrows). C. Post-contrast T1 sequence in axial plane showing thickening and diffuse enhancement of the fibrous capsule of the right implant (arrow).

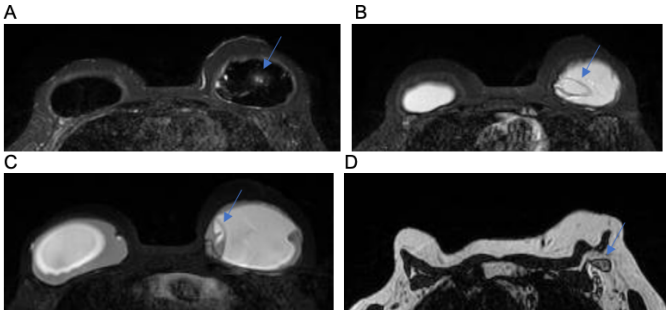

Figure 8. A, B, and C. Axial T2 sequences showing tiny liquid inclusions in the left implant (A and C) and "linguine sign" (B), suggestive of intracapsular rupture of the external lumen. D. T1 sequence in axial plane showing left axillary lymph node enlargement, with a heterogeneous signal similar to that of silicone (arrow), which may correspond to intra-nodal silicone and suggest ipsilateral extracapsular rupture.

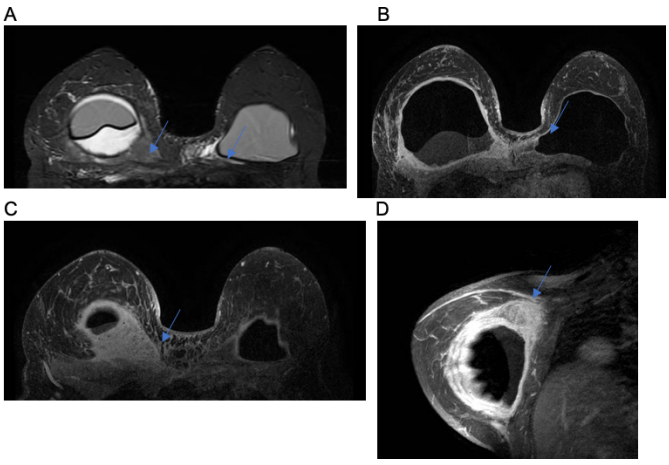

Figure 9. A. T2 sequence in the axial plane showing loss of lobulations and rounded morphology of the right implant, associated with a pericapsular seroma displacing this implant anteriorly, in addition to diffuse edema of the underlying pectoral muscle (arrow) and the medial aspect of the contralateral pectoral muscle (arrow). B, C, and D. Post-contrast T1 sequences in axial (B and C) and sagittal planes (D) showing marked thickening and irregular diffuse pericapsular enhancement of the right implant, especially in its posterosuperior aspect (C and D - arrow), with pre-sternal extension towards the fibrous capsule of the contralateral implant (B - arrow) and associated with thickening and faint skin enhancement in the lower and medial quadrants of the right breast.

pleural fluid. Thus, the possible change in two patients in group 2 with axillary lymph node disease and intra-node silicone can be explained. When gel extravasation is extensive, it can be detected by imaging examination, resulting in the formation of the inverted tear sign[6,10].

Capsular granuloma was evident in two patients, as seen in Figures 2D, 4A and 4B. Furthermore, edema of the pectoral muscle was noted in one patient, as shown in Figure 9A. The changes in question can be explained by the literature. In this case, the implant's silicone gel may have its envelope dissolved over time, making its coating thinner, or even dissolved completely, which makes the product viscous inside the organic fibrous capsule. Thus, in certain cases, there is migration of the viscous product to neighboring tissues, which can form granulations, inflammation of the skin with skin rash, urticaria, calcifications, migration to lymph nodes, or even infiltration into chest muscles, simulating tumors[25].

Desmoid fibromatosis (DF) is a non-metastatic, rare, locally aggressive myofibroblastic tumor, with high recurrence rates (24-77%) and an unpredictable clinical course. The incidence is approximately 0.2% of all breast neoplasms[28]. The most affected site is intra-abdominal, with the breast being an extremely rare condition[29]. Two patients were found in whom the hypothesis of malignant breast tumor was initially raised, which the biopsy and immunohistochemistry results confirmed to be a desmoid tumor. In immunohistochemistry, the positive presence of actin and vimentin, desmin is rarely positive, while S100 and CD34 are negative, being useful for the diagnosis of desmoid tumor[29].

On MRI, desmoid tumors are typically irregular masses, with a poorly defined contour, hypointense, and isointense concerning the muscle in T1-weighted sequences and with variable signal hyperintensity in T230-weighted sequences. These findings are evidenced in Figures 11A, 11B, 12A and 12B.

Diagnostic investigation through imaging tests such as magnetic resonance imaging can facilitate the elucidation of so-called "unusual" complications in breast implant surgeries. Given these possible changes, the patient must be informed in advance about the inclusion of breast implants, as her decision may have future implications, requiring new surgical interventions for treatment if complications occur.

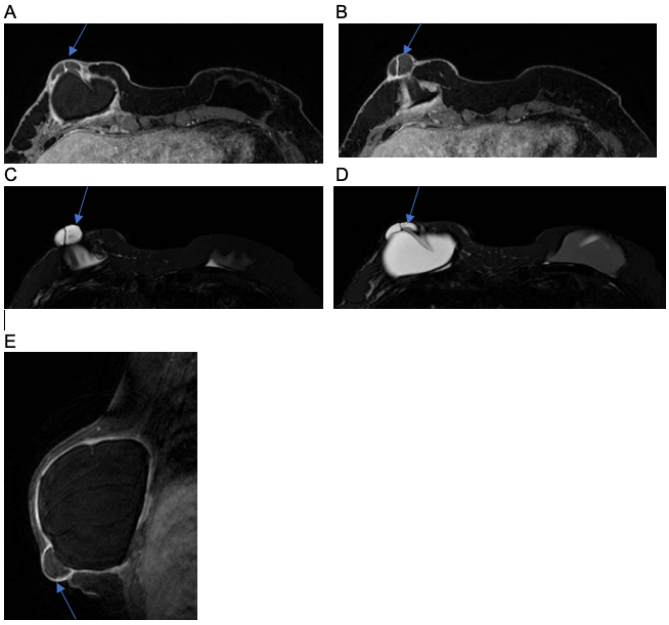

Figure 10. Post-contrast T1 sequences in the axial plane (A and B) and T2 sequences in the axial plane (C and D) showing herniation of the fibrous capsule with heterogeneous content in the inferolateral quadrant of the right breast (arrows). E. Post-contrast T1 sequence in sagittal plane showing the subcutaneous location of the herniation, in close contact with the skin (arrow).

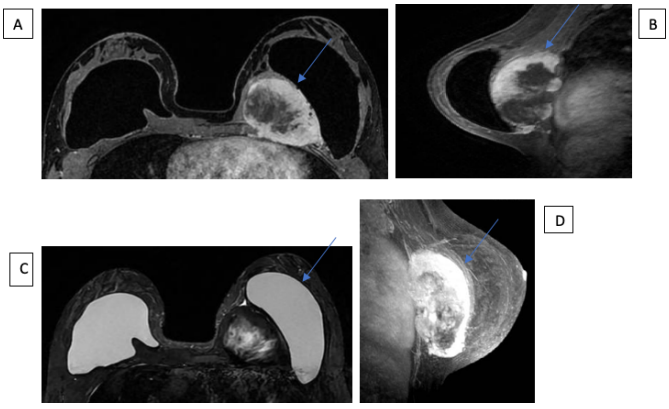

Figure 11. In the topography of the left pectoral muscle, in its central and medial aspects, at the level of the second to fifth intercostal spaces, there is a heterogeneous solid-cystic nodular image, with irregular thick walls and heterogeneous enhancement, measuring 9.4 x 7.2 x 5.0 cm, with rapid initial enhancement and persistent type kinetic curve. This nodular image displays intimate contact with the implant capsule (with its enhancement and displacing the implant anteriorly) and also displays contiguity with the intercostal muscles posteriorly (with its enhancement), attached to the pulmonary pleura and pericardium in the respective intercostal spaces and without enhancement of the adjacent costal arches and cartilages.

CONCLUSION

It is estimated that there are 50 million women with breast implants in the world. The number of women undergoing breast augmentation with silicone implants tends to increase and Brazil is one of the main countries in statistical numbers. Based on this trend, the number of so-called "unusual" complications becomes a diagnostic challenge for plastic surgeons and radiologists.

In the present study, a low incidence of unusual complications was found, with 12 cases out of 211

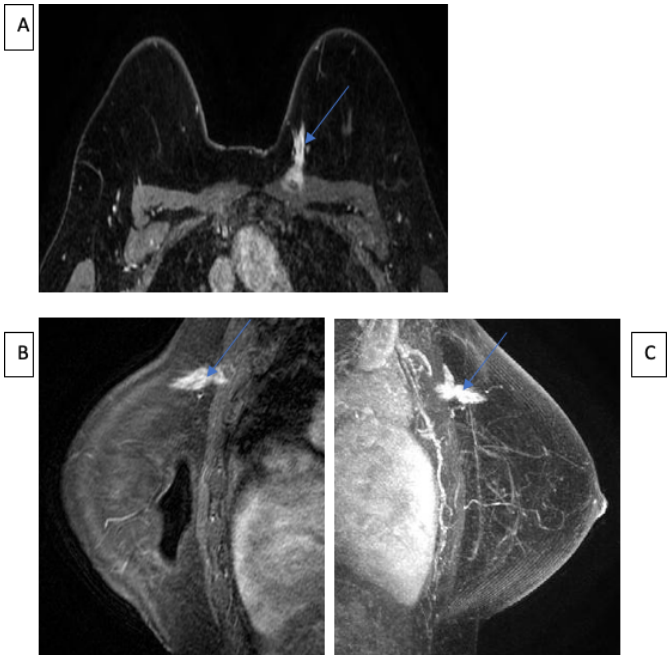

Figure 12. In the superomedial quadrant of the left breast, 11 o'clock, posterior third, close to the presternal region, there is nodular, irregular, spiculated, heterogeneous enhancement, measuring 3.4 x 3.2 x 2.2 cm, 9.7 cm away from the nipple-areola complex and invading the anterior half of the ipsilateral pectoral muscles, with rapid initial enhancement and persistent type kinetic curve.

analyzed using breast MRI. This diagnostic method helps in the early detection of these changes and provides greater safety for post-operative monitoring, due to its high sensitivity and specificity, playing a central role in therapeutic guidance.

COLLABORATIONS

IMS Writing - Original Draft Preparation.

MCC Writing - Review & Editing.

REFAC Supervision.

SFAG Analysis and/or data interpretation.

MSV Methodology.

JCD Supervision.

REFERENCES

1. Baker JL Jr, Kolin IS, Bartlett ES. Psychosexual dynamics of patients undergoing mammary augmentation. Plast Reconstr Surg. 1974;53(6):652-9.
2. Pitanguy I, Barbato C, Dègand M, Lopez CET. Mamoplastia de aumento: considerações sobre a retração capsular. Rev Bras Cir. 1979;69(7/8):237-50.
3. Montandon RE. A report on complications of breast implantation: evaluation of 546 cases in 8 years. Rev Bras Cir Plást. 2014;29(3):352-60.
4. Pitanguy I, Amorim NFG, Ferreira AV, Berger R. Análise das trocas de implantes mamários nos últimos cinco anos na clínica Ivo Pitanguy. Rev Bras Cir. 2010;25(4):668-74.
5. Gorczyca DP, Gorczyca SM, Gorczyca KL. The diagnosis of silicone breast implant rupture. Plast Reconstr Surg. 2007;120(7 Suppl 1):49S-61S.
6. Dancey A, Nassimizadeh A, Levick P. Capsular contracture - What are the risk factors? A 14 year series of 1400 consecutive augmentations. J Plast Reconstr Aesthet Surg. 2012;65(2):213-8.
7. McGrath MH, Burkhardt BR. The safety and efficacy of breast implants for augmentation mammaplasty. Plast Reconstr Surg. 1984;74(4):550-60.
8. Wiedenhoefer JF, Shahid H, Dornbluth C, Otto P, Kist K. MR imaging of breast implants: useful information for the interpreting radiologist. Appl Radiol. 2015;44(10):18-24.
9. Sperli A, Bersou Jr. A, Freitas JOG, Michalany N. Complicações com Próteses Mamárias. Rev Bras Cir Plást. 2000;15(3):33-46.
10. Franco T, Franco D. Seroma tardio após implantes mamários de silicone: três formas diferentes de apresentação, evolução e conduta. Rev Bras Cir Plást. 2013;28(2):247-52.
11. Nahabedian MY, Patel K. Management of common and uncommon problems after primary breast augmentation. Clin Plast Surg. 2009;36(1):127-38.
12. Biggs TM, Cukier J, Worthing LF. Augmentation mammaplasty: a review of 18 years. Plast Reconstr Surg. 1982;69(3):445-52.
13. De Cholnoky T. Augmentation mammaplasty. Survey of complications in 10,941 patients by 265 surgeons. Plast Reconstr Surg. 1970;45(6):573-7.
14. Colombo G, Ruvolo V, Stifanese R, Perillo M, Garlaschi A. A. Prosthetic breast implant rupture: imaging--pictorial essay. Aesthetic Plast Surg. 2011;35(5):891-900.
15. Seiler SJ, Sharma PB, Hayes JC, Ganti R, Mootz AR, Eads ED, et al. Multimodality Imaging-based Evaluation of Single-Lumen Silicone Breast Implants for Rupture. Radiographics. 2017;37(2):366-82.
16. Barra RF, Barra RR, Barra Sobrinho A. Novos métodos funcionais na avaliação de lesões mamárias. Radiol Bras. 2012;45(6):340-4.
17. Cordeiro PG, Ghione P, Ni A, Hu Q, Ganesan N, Galasso N, et al. Risk of breast implant associated anaplastic large cell lymphoma (BIA-ALCL) in a cohort of 3546 women prospectively followed long term after reconstruction with textured breast implants. J Plast Reconstr Aesthet Surg. 2020;73(5):841-6.
18. Argus A, Mahoney MC. Indications for breast MRI: case-based review. AJR Am J Roentgenol. 2011;196(3 Suppl):WS1-14.
19. De-Azambuja AP, Groth AK, Jung J, Gevert F, Nabhan SK. Breast implant-associated anaplastic large cell lymphoma: a diagnostic challenge. Rev Bras Cir Plást. 2020;35(1):118-20.
20. Juanpere S, Perez E, Huc O, Motos N, Pont J, Pedraza S. Imaging of breast implants-a pictorial review. Insights Imaging. 2011;2(6):653-70.
21. Stöblen F, Rezai M, Kümmel S. Imaging in patients with breast implants-results of the First International Breast (Implant) Conference 2009. Insights Imaging. 2010;1(2):93-7.
22. Yang N, Muradali D. The augmented breast: a pictorial review of the abnormal and unusual. AJR Am J Roentgenol. 2011;196(4):W451-60.
23. Soo MS, Kornguth PJ, Walsh R, Elenberger C, Georgiade GS, DeLong D, et al. Intracapsular implant rupture: MR findings of incomplete shell collapse. J Magn Reson Imaging. 1997;7(4):724-30.
24. Schmitt W, Coelho JM, Lopes J, Marques JC. O Papel da Radiologia na Monitorização das Complicações Relacionadas com as Próteses Mamárias. Acta Radiol Port. 2018;30(1):23-34.
25. Takejima AL. Ruptura de implante mamário com disseminação linfática do silicone: relato de caso e revisão da literatura

[Trabalho de Conclusão de Curso em Residência Médica]. São Paulo: Hospital do Servidor Público Municipal; 2011.
26. Pinchuk V, Tymofii O. Seroma as a late complication after breast augmentation. Aesthetic Plast Surg. 2011;35(3):303-14.
27. Moore KL, Daley AF. Anatomia orientada para a clínica. 7ª ed. Rio de Janeiro: Guanabara Koogan; 2014.
28. Benej R, Mečiarová I, Pohlodek K. Desmoid-type fibromatosis of the breast: A report of 2 cases. Oncol Lett. 2017;14(2):1433-8. DOI: 10.3892/ol.2017.6337
29. Duazo-Cassin L, Le Guellec S, Lusque A, Chantalat E, Laé M, Terrier P, et al. Breast desmoid tumor management in France: toward a new strategy. Breast Cancer Res Treat. 2019;176(2):329-35. DOI: 10.1007/s10549-019-05245-5
30. Erguvan-Dogan B, Dempsey PJ, Ayyar G, Gilcrease MZ. Primary desmoid tumor (extraabdominal fibromatosis) of the breast. AJR Am J Roentgenol. 2005;185(2):488-9.

***Corresponding author:** **Igor Moura Soares**
Quadra SHIS QI 7, conjunto F, área especial F, Setor de Habitações Individuais Sul, Brasília, DF, Brazil
Zip Code: 71615-660
E-mail: igormoura739@gmail.com