Original Article

Aggressive fibromatosis (desmoid tumor) associated with breast implant: literature review and presentation of three new cases

Fibromatose agressiva (tumor desmoide) associada a implante mamário: revisão da literatura e apresentação de três novos casos

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■ **ABSTRACT**

Introduction: Fibromatoses consists of the proliferation of fibrous tissue, in the form of bands or nodules, associated with fasciae and aponeuroses. The aggressive variety, previously denominated desmoid tumor, behaves similarly to malignant neoplasm, with local destruction of tissues, without, however, producing metastases. **Methods:** A literature review was carried out from 1979 to January 2017. Data from three patients, operated between May 2010 and August 2015, were reviewed. Age, implant characteristics, route of introduction, time elapsed between implantation and fibromatosis, surgical treatment, clinical follow-up and results were observed. **Results:** Twenty-four papers were found in the literature reporting aggressive fibromatosis of the chest wall associated with silicone breast implant. In these studies, 34 cases were reported. Three new cases of aggressive fibromatosis associated with silicone breast implant are now presented. These cases were successfully treated by extensive resection of the chest wall, including skin, musculature, ribs, endothoracic fascia, and parietal pleura. The reconstruction was successful, performed with alloplastic mesh (Prolene®) covered by muscular flap in two cases and local skin flap in one case. **Conclusion:** The association of aggressive fibromatosis and breast implant is rare. The treatment should consist of extensive surgery, removing the breast implant and the entire area of the capsule around it, part of breast, together with the underlying ribs, intercostal muscles, endothoracic fascia and parietal pleura. The reconstruction should be made with an alloplastic mesh, covered by muscular flaps or local skin flap.

Keywords: Fibromatosis aggressive; Breast implantation; Mammaplasty.

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■ **RESUMO**

Introdução: As fibromatoses consistem na proliferação de tecido fibroso, na forma de faixas ou nódulos, associadas às fáscias e aponeuroses. Sua variedade agressiva, denominada previamente tumor desmoide, se comporta de forma semelhante a uma neoplasia maligna, com destruição local de tecidos, sem, entretanto, originar metástases. **Métodos:** Fez-se revisão da literatura de1979 a janeiro de 2017. Dados de três pacientes, operados entre maio de 2010 e agosto de 2015, foram revistos, com proservação até março de 2017. Observaram-se idade, características do implante, via de introdução do mesmo, tempo decorrido entre o implante e o aparecimento da fibromatose, tratamento cirúrgico instituído, acompanhamento clínico e resultados. **Resultados:** Foram encontrados 24 trabalhos na literatura disponível, versando sobre fibromatose agressiva da parede torácica associada a implante mamário de silicone, nos quais foram relatados 34 casos. São apresentados três casos de fibromatose agressiva associados a implante mamário de silicone. Os casos foram tratados com sucesso por ressecção alargada da parede torácica, incluindo pele, musculatura, costelas, fáscia endotorácica e pleura parietal. A reconstrução foi bem-sucedida, realizada com tela aloplástica (Prolene®) recoberta por retalho muscular em dois casos e retalho cutâneo local em um caso. **Conclusão:** A associação de fibromatose agressiva e implante mamário é rara. O tratamento deve consistir em cirurgia alargada, removendo-se o implante e toda a área da cápsula adjacente, em conjunto com parte da mama, costelas subjacentes, musculatura intercostal, fáscia endotorácica e pleura parietal. A reconstrução deve ser feita com tela aloplástica associada a retalho muscular ou retalho tegumentar local.

Descritores: Fibromatose agressiva; Implante mamário; Mamoplastia.

INTRODUCTION

The first case of desmoid tumor (aggressive fibromatosis) was described by McFarlane (1832)[1], who reported the disease occurring in the anterior abdominal wall in a young woman after childbirth. According to Dorland's Illustrated Medical Dictionary[2], the word "desmoid" is derived from Greek (desmos = ligament + eidos = form), i.e., the tumor has a ligament form.

The term "desmoid" was coined by Müller, in 1838[3]. According to Kallam et al.[4], desmoid tumors are classified in three types according to their location. The first one is the abdominal, which affects the anterior abdominal wall; the second type is the intra-abdominal, that affects the mesentery and the pelvis, in intra or retroperitoneal situation; the third type is the extra-abdominal, that affects the chest, extremities, head and neck.

From and Assaad[5] studied aggressive fibromatoses (AF) or desmoid tumors, noting that the disease may affect several regions of the body, more often the anterior wall of the abdomen and the shoulder girdle. It is more common in puerperae and in places of abdominal scarring. Desmoid tumors grow relentlessly, invade surrounding tissues, and can reach vital organs. Retroperitoneal desmoid tumors occur in Gardner's syndrome, especially after intra-abdominal operations.

Gardner's syndrome[6], (familial adenomatous polyposis FAP), was described in 1951, initially called familial polyposis coli (FPC). It consists of polyposis of the cervix subject to malignization, osteomas of the skull and mandible, epidermoid cysts, desmoid tumors, tumors of the ovary, small intestine, thyroid and adrenal. The syndrome is associated with the mutation of an autosomal dominant tumor suppressor gene called APC (adenomatous polyposis coli) located on the long arm of chromosome 5[6].

According to Weiss[7], the desmoid tumor is known as "deep or muscle-aponeurotic fibromatosis". The disease mainly affects the abdominal wall and abdominal cavity, the scapular girdle and the anterior and posterior thoracic

walls. About 1% of aggressive fibromatoses are familial, although unrelated to Gardner's syndrome[7]. Lesions that appear in childhood often occur in the head and neck.

The histopathological picture shows large fascicles of dense fibrous tissue with abundance of collagen (Figure 1). Among the collagen fibers, there are spindle-shaped cells with thin, conical nuclei at their extremities. Nuclei have no atypia and have a vesicular pattern of chromatin. The mitotic index is low. Immunohistochemistry reveals that spindle cells are positive for intracellular betacatenin, muscle-specific actin, and the smooth muscle alpha isoform[7].

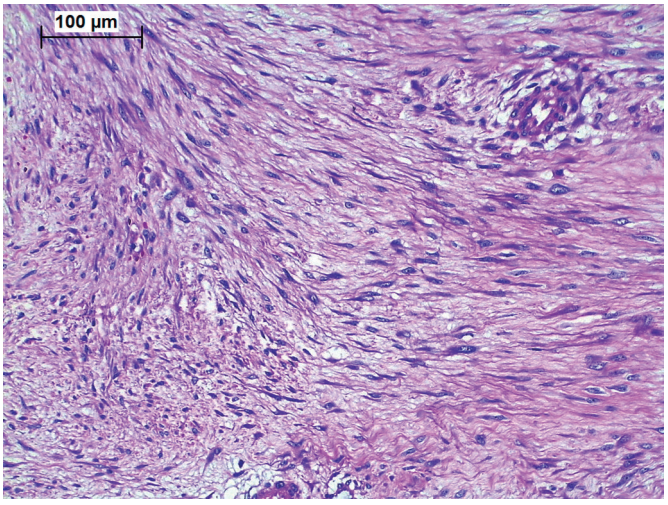

Figure 1. Photomicrography in hematoxylin-eosin: fibromatosis invading muscle tissue.

Many cases show receptors for estrogen and progesterone[7]. Hormone therapy has been indicated to control the neoplasia[8-11]. In the differential diagnosis, nodular fasciitis, neurofibroma, fibrosarcoma and low grade fibromyxoid sarcoma should be considered. Intranuclear betacatenin expression is highly specific for aggressive fibromatosis and is not observed in other fusiform cell lesions[7] (Figure 2).

In Brazil, the first report of desmoid tumor associated with aesthetic surgery was made by Caldeira et al (2006)[12], who described a case of neoplasia in the abdominal wall of a woman in the right hypochondrium region, after liposuction. The first case of desmoid tumor of the chest wall associated with silicone breast implant was reported by Jewett Jr and Mead (1979)[13]. In the consulted literature, 24 studies report the association of breast implant and aggressive fibromatosis. According to MeSH (medical subject headings), a database that supports research in PubMed, the US National Library of

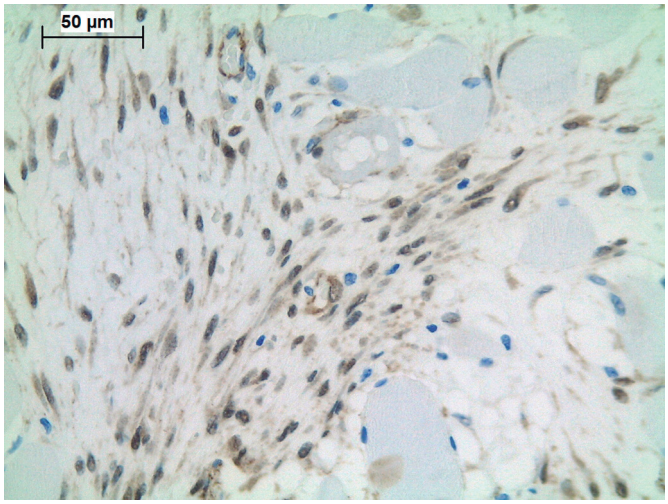

Figure 2. Photomicrography of immunohistochemistry: β-catenin expression.

Medicine, the descriptor "desmoid tumor" was replaced by "aggressive fibromatosis" (AF) in 1994.

OBJECTIVE

To review the literature from the first case published in 1979 until January 2017. Present three new cases of aggressive fibromatosis (AF) associated with silicone breast implants.

METHODS

A literature review was carried out from 1979 to January 2017. Twenty-four published papers with the association FA and breast implant were found, describing 34 cases. The following key-words were investigated: fibromatosis, aggressive; desmoid, breast implants, mammoplasty, breast implantation. The main data for all 34 patients reported were summarized in Chart 1[8,9,11,13-33].

Data from three patients, operated on from May 2010 to August 2015, two of them treated by the Plastic Surgery and Thoracic Surgery clinics at Hospital Felício Rocho, and one treated at Hospital Júlia Kubitschek (Fundação Hospitalar do Estado de Minas Gerais), in Belo Horizonte, MG, were reviewed retrospectively. Age, implant characteristics, route of introduction, time elapsed between implantation and the onset of fibromatosis, surgical treatment, clinical follow-up and results were observed.

There were no conflicts of interest and no funding sources. The principles of the Declaration of Helsinki revised in 2000 and Resolution 196/96 of the National Health Council were followed. All patients received the Informed Consent Form.

Chart 1. Review of published papers with the association FA and breast implants.

Author/year	Age (years)	Implants Biomaterial	Previous disease	Side	Tumor size (cm)	Access	Time elapsed after implant	Treatment	Implants destination	Outcome
Jewett Jr and Mead (1979)[13]	54	Saline	Fibrocystic disease: subcutaneous mastectomy with implants	Left	1,5 x 3 cm	Subcutanous	22 months	Wide resection	Removed	RF after 8 months
Rosen and Ernsberger (1989)[8]	35	Saline	Breast hypoplasia	Right	NR	NR	Several years	Economical resection: posteriorly, cancer mastectomy	Removed	Recurrences at 7 and 18 months. RF 12 months since mastectomy
Schuh and Radford (1994)[14]	41	Silicone gel	Breast hypoplasia	Left	5 x 6,5 cm	Submuscular	24 months	Wide resection	Replaced	RF after 36 months
Crestinu (1995)[15]	NR	Saline replaced by silicone gel	Breast hypoplasia	Right	NR	NR	23 months	Wide resection	Replaced	RF after 90 months
Schiller et al. (1995)[16]	65	Silicone gel	Breast hypoplasia	Right	13 cm	Subglandular	NR	Radical mastectomy including two ribs resection	Removed	NR
Dale et al. (1995)[9]	65	Silicone gel	Breast cancer: modified radical mastectomy using implants	Right	13 cm	Submuscular	84 months	Wide resection including two ribs; Marlex® mesh, latissimus dorsi myocutaneous flap	Removed	NR
Aaron et al. (1996)[17]	43	Silicone gel replaced by saline	Breast hypoplasia	Left	6 x 6 cm	NR	24 months	Wide resection; thoracectomy including removal of two ribs; Marlex® mesh; latissimus dorsi myocutaneous flap	Mantained	RF after 12 months
Vandeweyer and Deraemaecker (2000)[18]	45	Saline replaced bysilicone gel	Breast cancer: modified radical mastectomy using implants	Left	3 cm	Subcutaneous	36 months	Wide resection and radiotherapy	Removed	RF after 24 months
Abraham et al. (2002)[19]	30	Silicone gel	NR	Left	1,8 cm	NR	NR	NR	NR	NR
	43	Silicone gel	Recurrent fibromatosis: mastectomy and implants	Left	3 cm	Subcutaneous	NR	NR	NR	NR
Khanfir et al. (2003)[20]	52	Saline	Breast cancer: mastectomy including implants	Left	8 x 5 cm	Subcutaneous	19 months	Wide resection; chemo, radiation and hormone therapy; radical surgery with partial sternectomy and four ribs resection	Removed	NR
Jandali et al. (2004)[21]	24	Silicone gel	Breast asymmetry	Left	4 x 2 x 6 cm	Submuscular	108 months	Wide resection and radiotherapy: recurrence at three years with another wide resection	Replaced	Recurrence after 36 months with another wide ressection
Gandolfo et al. (2006)[22]	22	Silicone gel	Breast asymmetry	Left	16 cm	NR	24 months	Wide resection	Removed	NR
Neuman et al. (2008)[23]	NR	NR	Breast cancer: radical mastectomy using implant	NR	NR	NR	NR	NR	NR	NR
	NR	NR	Breast cancer: radical mastectomy using implant	NR	NR	NR	NR	NR	NR	NR
	NR	NR	Breast cancer: radical mastectomy using implant	NR	NR	NR	NR	NR	NR	NR
	NR	NR	Breast hypoplasia	NR	NR	NR	NR	NR	NR	NR
	NR	NR	Breast hypoplasia	NR	NR	NR	NR	NR	NR	NR

continue...

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Chart 1. Review of published papers with the association FA and breast implants.

Jamshed et al. (2008)[24]	30	Saline	Breast hypoplasia	Left	6 x 5 x 2,5 cm	NR	36 months	Wide resection including ribs; mehylmetacrilate prosthesis and latissimus dorsi myocutaneous flap	Removed	RF after 24 months
Balzer and Weiss (2009)[25]	64	Silicone gel	NR	NR	6,7 cm	NR	21 months	Wide resection	NR	RF after 40 months
	NR	Silicone gel	NR	NR	4,5 cm	NR	24 months	Wide resection	NR	RF after 48 months
	37	Silicone gel	NR	NR	3,3 cm	NR	30 months	Wide resection	NR	RF after 42 months
	28	Silicone gel replaced by saline	NR	NR	11 cm	NR	24 months	Wide resection	NR	Reurrence at 19 and 24 months. RF after 46 months
	38	Silicone gel	NR	NR	12 cm	NR	24 months	Parcial resection	NR	Alive with disease after 46 months
	29	Silicone gel replaced by saline	NR	NR	7,4 cm	NR	24 months	Biopsy with refusal of wide resection; chemotherapy and radiotherapy	Mantained	RF after 92 months
Mazzocchi et.al (2009)[26]	52	Silicone Gel	Breast hypoplasia	Left	4 x 4,5 x 1,5 cm	Subglandular	48 months	Wide resection followed by new subglandular implant	Replaced	RF after 36 months
	38	Silicone gel	Breast hypoplasia	Right	1,5 x 1 x 1 cm	Subglandular	84 months	Wide ressection followed by new subglandular implant	Replaced	RF after 12 months
Chummun et al. (2010)[27]	22	Silicone gel	Breast hypoplasia	Left	5 x 4 cm	NR	24 months	Resection	Replaced	RF after 5 months
Henderson et al. (2010)[28]	27	Saline	Breast hypoplasia	Right	14 x 9 x 2,5 cm	NR	30 months	Resection	Replaced	RF after 24 months
Mátrai et al. (2011)[11]	34	Silicone gel	Breast hypoplasia	Right	4 x 4 cm	Submuscular	24 months	Resection and e hormone therapy	Removed	RF after 55 months
Gergelé et al. (2012)[29]	43	NR	Câncer de mama: mastectomia radical e prótese	Left	6,7 x 4,8 cm	NR	36 months	Biopsy, follow-up and anti-inflam-matory	Mantained	NR
Hammoudeh e Darian (2012)[30]	38	Saline	Breast hypoplasia	Left	3,5 x 3 x 1,3 cm	Submuscular	48 months	Tumor resection and capsulectomy	Replaced	NR
Jeong et al. (2013)[31]	34	Silicone gel	Breast hypoplasia	Left	6,4 x 2,6 x 5,8 cm	Submuscular	25 months	Tumor resection without free margins	Removed	Refusal of radical surgery; loss of follow-up
Shim et al. (2014)[32]	29	NR	Breast hypoplasia	Left	NR	NR	24 months	Wide resection	Removed	RF after 8 months
Seo et al. (2015)[33]	27	Saline	Breast hypoplasia	Right	NR	Submuscular	24 months	Parcial resection	Removed	Presence of residual injury without further information

NR: Not reported; RF: Recurrence free.

RESULTS

Twenty-four papers reporting 34 cases of FA associated with silicone breast implant were found. Chart 1 summarizes data regarding age, characteristics of the implant, route of introduction, time elapsed between the introduction of the implant and the appearance of AF, surgical treatment, clinical follow-up and results.

The three new cases reported in the present study were operated with the removal of the prosthesis and enlarged resection of the affected thoracic wall, comprising the capsule formed around the implants, breast tissue, underlying muscles, intercostal muscles, rib and sternum segments, endothoracic fascia and parietal pleura. The lateral resection margin was 5 cm. In these cases the parietal pleura had not been reached.

Thoracic wall reconstruction was performed by using the Prolene® alloplastic mesh, *latissimus dorsi* flaps in two cases and skin flap in one case. In case 1, the patient presented 82 months of disease-free follow-up. At 4 years and 8 months of follow-up, the patient received new silicone breast implants. In case 2 the patient developed mild paradoxical breathing and is waiting for reinforcement of the chest wall to treat the complication.

The mean follow-up of the three patients was 45 months.

Cases report

Case 1

Female, born on 09/04/1980. On May 21, 2008, the patient was received textured silicone gel implants submuscularly (Sebbin®, 245 ml) for the treatment of mammary hypoplasia. Previously, on 12/12/2003, she had undergone treatment of ulcerated extensive superficial melanoma (Breslow 1 mm, Clark 3) in the right parasternal pectoral region, with biopsy of a negative right axillary sentinel lymph node.

Twenty-three months later, aged 29 years and five months, she presented a tumor in the left mammary region, lateral sector, measuring 4.7 x 2.3 cm, as determined by magnetic resonance imaging. The biopsy revealed aggressive fibromatosis. The enlarged resection of the lesion was performed on 05/06/2010, which consisted of thoracectomy including skin, subcutaneous tissue, breast tissue, major pectoralis muscle segments, rib segments (2nd, 3rd and 4th), removal of the implant and the entire surrounding capsule, intercostal muscles, endothoracic fascia, and parietal pleura.

The lateral resection margin was 5 cm. The entire lesion was excised in monoblock. The tumor occupied the lateral portion of the implant capsule. Reconstruction was performed using alloplastic mesh (Prolene®) and *latissimus dorsi* muscular flap. Conventional thoracic drainage was used for four days. Anatomopathological examination showed the lesion measured 7cm in diameter. The surgical specimen presented disease-free margins both laterally and in depth, confirming the diagnosis of aggressive fibromatosis. The patient presented seroma in the operated area that was treated through successive aspirations.

The patient became pregnant and, on 02/09/2012, she gave birth to a healthy, female child through cesarean section and breastfed in both breasts for two months. On 01/13/2015, the implant was replaced on the right side and new textured Eurosilicone® implants were placed (240 ml left and 220 ml right). On January 23, 2017 the patient was disease free after enlarged resection treatment, presenting 80 months follow-up (Figures 3 to 10).

Case 2

Female, 22 years and 5 months, presented in April 2008 with breast hypertrophy and asymmetry (greater breast on the right). She was submitted to reduction mammoplasty through perioareolar incision and subglandular textured implants (PIP silicone gel, 220 ml). On 08/10/2010, she underwent mastopexy with change of

Figure 3. Location of neoplasia on the lateral side of the chest.

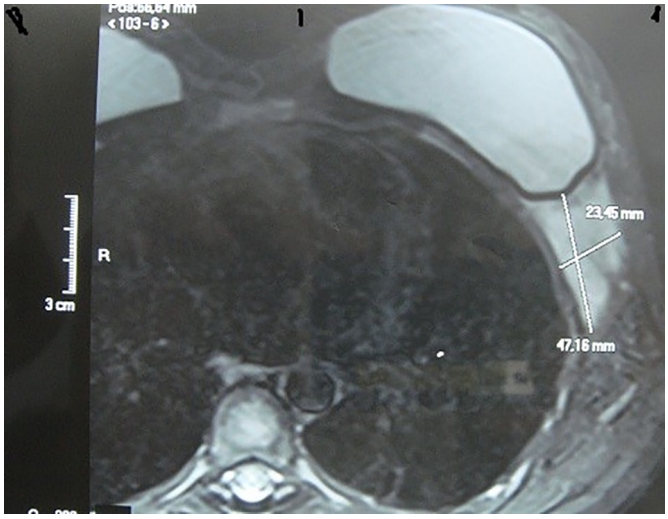

Figure 4. Tumor imaging by magnetic nuclear resonance.

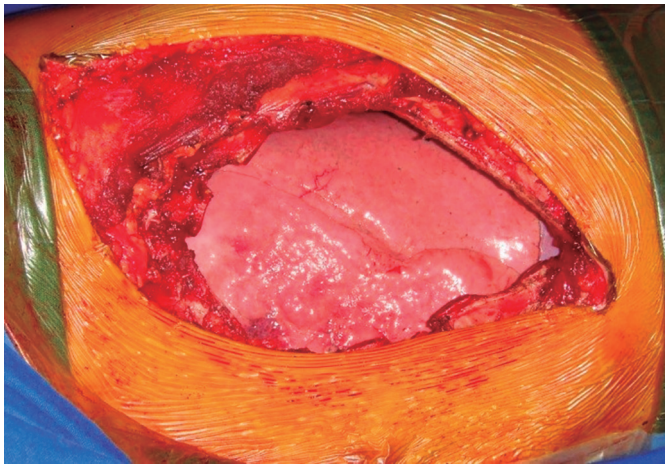

Figure 5. Loss of substance from the chest wall.

Figure 6. Latissimus dorsi muscle flap.

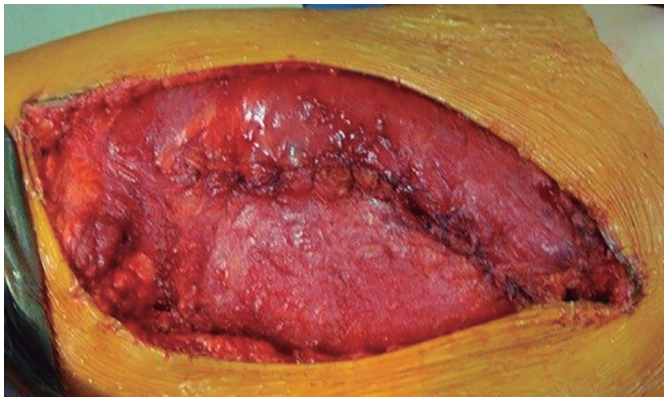

Figure 7. Muscle flap covering the alloplastic mesh.

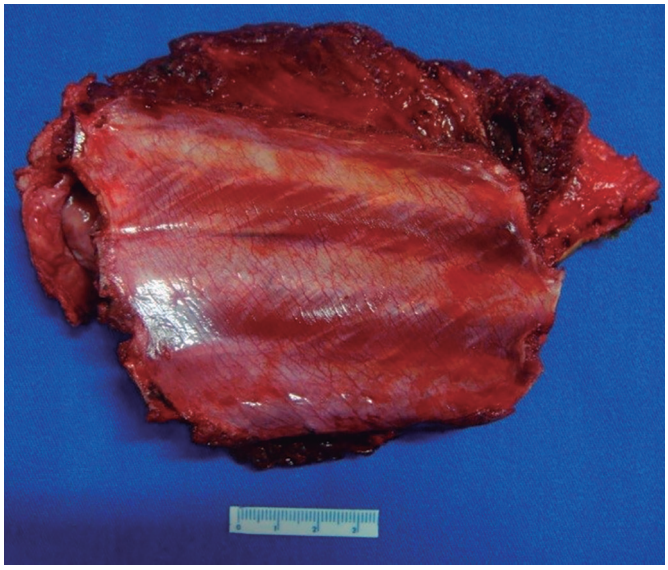

Figure 8. Resected ribs.

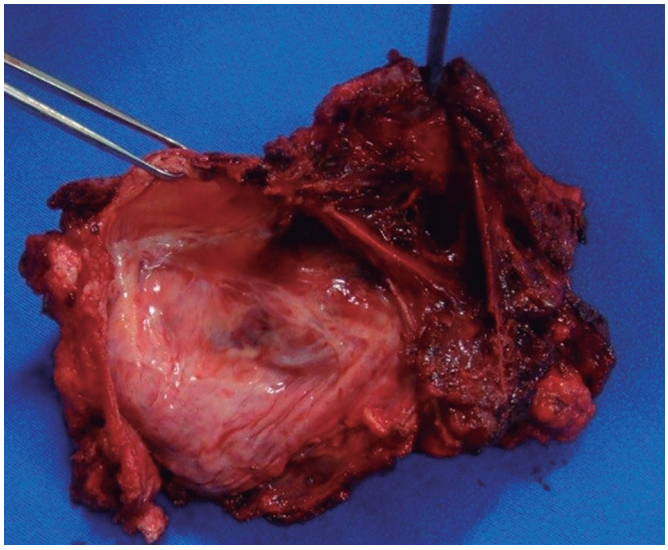

Figure 9. Implants capsule presenting AF.

implants to the submuscular position. On 12/02/2011, she presented a right inframammary tumor.

On January 17, 2012, the diagnosis of aggressive fibromatosis was made through biopsy. The patient underwent thoracectomy, the surgical specimen measuring 13 x11 x 6 cm and neoplasia infiltrating intercostal spaces measuring 6 x 5x 3.8 cm. Extensive monobloc resection included skin, breast tissue, major pectoralis muscle, anterior segments of three ribs, intercostal muscles, endothoracic fascia and parietal pleura, sternum margin and implant capsule. The lateral resection margin was 5 cm. The implants were removed.

In the reconstruction of the thoracic wall, a folded Prolene® mesh was used, forming two layers. Conventional thoracic drainage was performed for four days. The lesion infiltrates the posterior face of the capsule. The surgical specimen presented disease-free lateral and deep margins, confirming the diagnosis of aggressive fibromatosis totally removed. The last examination was performed at 51 months of follow-up, on 04/14/2016, the patient presenting paradoxical breathing in the area of reconstruction of the ribs, without recurrence of AF (Figures 11 to 16).

Figure 10. Pregnant patient, cured from aggressive fibromatosis.

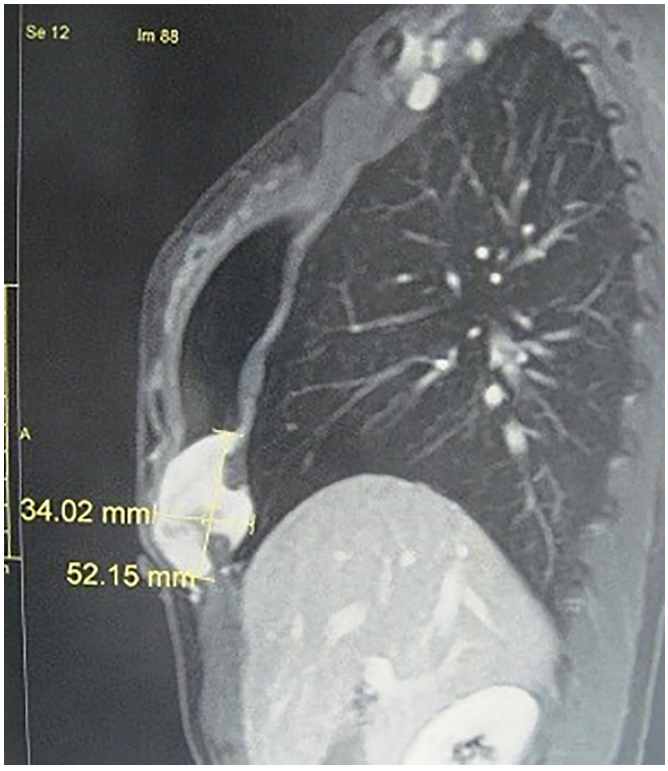

Figure 11. Computed tomography of lesions showing invation in two intercostal spaces.

Case 3

Female, 38 years presented at the Hospital Júlia Kubitschek in Belo Horizonte, Minas Gerais, Brazil, on 08/18/2015, with a tumor in the right thoracic wall, measuring 9.3 x 4.8 x 4.5cm by CT-scan. She had undergone a biopsy with the diagnosis of aggressive fibromatosis. She reported receiving 265 ml textured silicone gel implants of unknown brand, submuscular, approximately 12 years before.

About five years ago, she the prostheses replaced. The submuscular route was maintained, with periareolar access, using 320 ml silicone gel implants, Shangai Winner®. In July 2014, during pregnancy, she noticed a small nodule in the inferomedial quadrant of the right breast, which had appeared about four years before and had grown rapidly.

On 9/11/2015, she the implant was removed with an enlarged monobloc resection that included skin, breast tissue, pectoralis major muscle, right lateral segment of the sternum, anterior segments of four ribs (4th, 5th, 6th, and 7th), intercostal muscles, endothoracic fascia and parietal pleura as well as the entire implant capsule. The lateral resection margin was 5 cm. The reconstruction was made using polypropylene mesh (Prolene®) and skin flap. The patient was reviewed on 01/25/2016, at four months of follow-up and was disease-free (Figures 17 to 19).

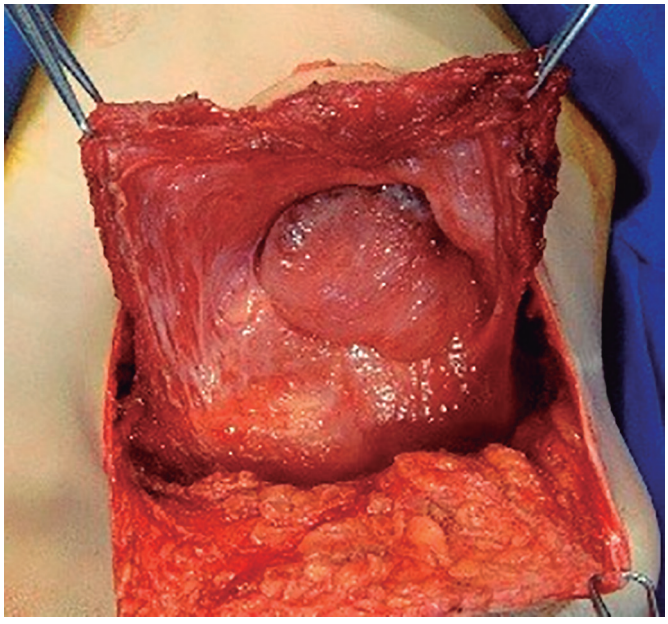

Figure 12. Open capsule showing aggressive fibromatosis.

DISCUSSION

Although classified as a benign tumor, AF is locally aggressive and has high rates of recurrence, destroying the surrounding tissues. Recurrence may lead to very

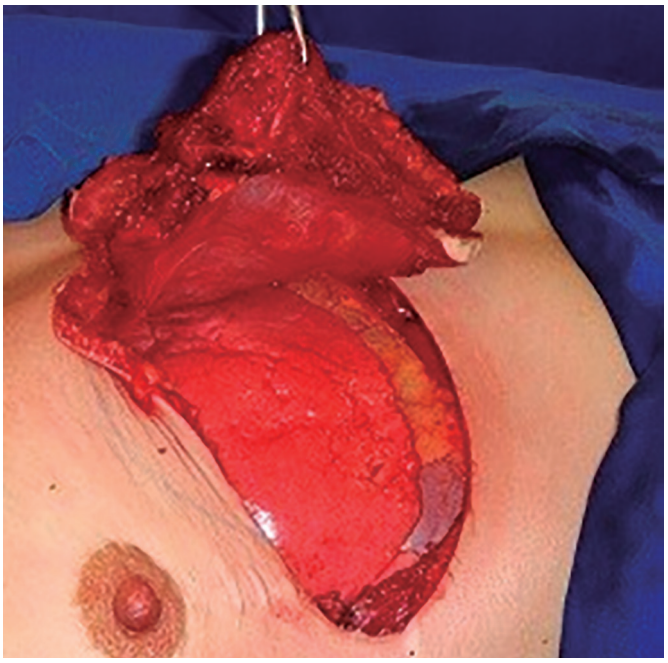

Figure 13. Enlarged thoracectomy.

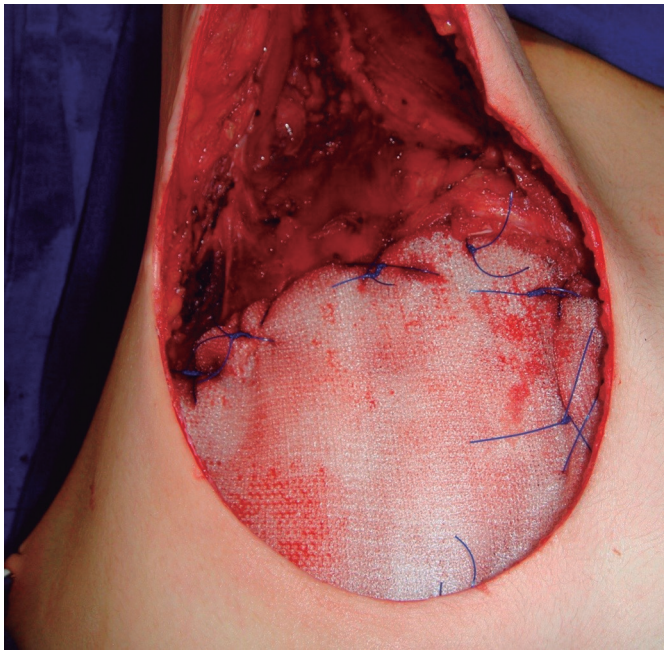

Figure 14. Alloplastic mesh.

difficult to treat cases because of the greater amount of tissue needed to be resected to achieve cure. The neoplasm may invade joints, thoracic and abdominal cavities, large vessels and nerves, presenting high local morbidity.

As economic resections lead to high rates of recurrence[5,8-10,17,26,27,33], the lateral surgical margins should be at least 5 cm and the deep margin should include an

Figure 15. Postoperative aspect.

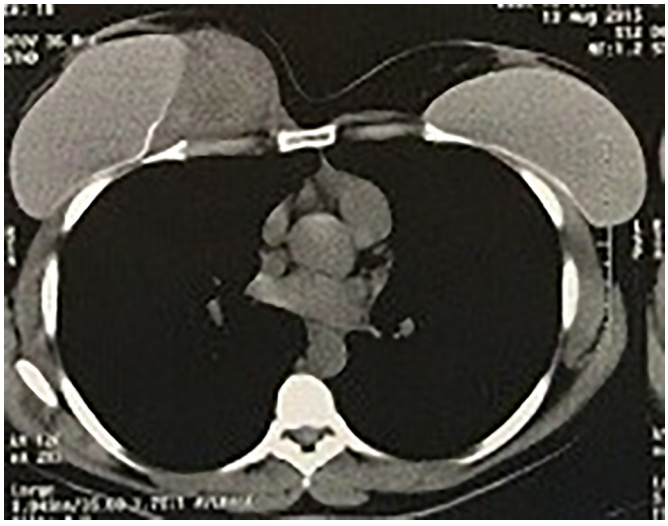

Figure 16. Computed tomography showing aggressive fibromatosis displacing right breast implant.

unaffected anatomical structure, such as muscle, bone or fascia[6]. It is impossible to know if in the cases described the tumor is a consequence of the surgical trauma caused by the augmentation mammoplasty or by the continuous trauma of the foreign body (breast implants) on the local tissues[13]. Because they are rare, these complications should be published in order to alert surgeons and patients about the nature of the disease.

The first authors to publish desmoid tumors related to the breast implant were Jewett Jr and Mead, in 1979[13]. There is a Brazilian article about AF related to cosmetic plastic surgery published by Caldeira et al.[12], in 2006, describing a case in the right hypochondrium diagnosed one year after an abdominal liposuction.

Chart 1 summarizes the characteristics of the 34 cases described in the 24 published articles. There is no evidence if implant biomaterial and the route of introduction interfere with the onset of AF, which may occur spontaneously or after traumatic injury to the fascia[9,25].

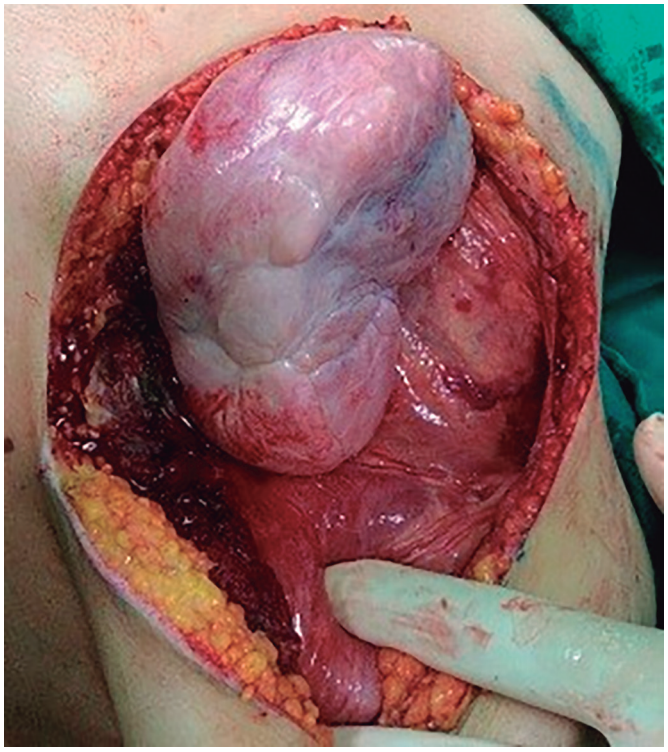

Figure 17. AF taking the form of a large tumor.

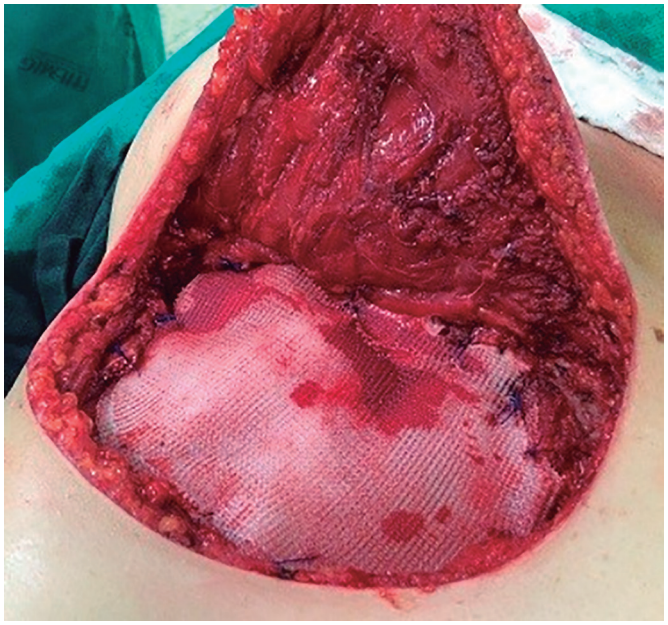

Figure 18. Reconstruction with alloplastic mesh.

CONCLUSION

A specific cause-effect relationship between breast implants and aggressive fibromatosis cannot yet be proven. It is accepted that any trauma of the fascia, surgical or otherwise, may be a potential inducer of neoplasia.

The biomaterials of silicone breast implants, as well as their route of placement, do not seem to interfere with the appearance of AF. The report of sparse cases is justified, given the rarity of the association of AF with silicone breast implants. The enlarged resection of the entire thickness of the affected chest wall with lateral margins of 5 cm and deep margin including the parietal pleura was adequate, promoting cure of the lesions in three patients submitted to a mean follow-up of 45 months.

Figure 19. Postoperative aspect.

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COLLABORATIONS

AFSF	Final approval of the manuscript; conception and design of the study; completion of surgeries and/or experiments; writing the manuscript or critical review of its contents.
JCRRA	Analysis and/or interpretation of data; statistical analyses; final approval of the manuscript; conception and design of the study; completion of surgeries and/or experiments; writing the manuscript or critical review of its contents.
EHP	Analysis and/or interpretation of data; statistical analyses; final approval of the manuscript; conception and design of the study; writing the manuscript or critical review of its contents.
RPLF	Analysis and/or interpretation of data; statistical analyses.
ACMA	Statistical analyses.

NAP Final approval of the manuscript.
FLS Completion of surgeries and/or experiments.
EFC Completion of surgeries and/or experiments.
JSAF Completion of surgeries and/or experiments.

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