ORIGINAL ARTICLE

Neck Lymphadenitis Due to Silicone Granuloma After Mammary Implants

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PALABRAS CLAVE
Siliconoma; Adenitis granulomatosa;

Abstract

Introduction: A foreign body reaction due to silicone where it is infiltrated or at the places to which it can migrate is known as siliconoma. The use of silicone in breast augmentation procedures can provoke this reaction at the neck level in cases of leakage from mammary implants.

Methods: We reviewed the cases of patients with increased size neck lymph nodes who had previously undergone plastic surgery of the breast with highly cohesive silicone gel implants.

Results: In a 10-year period, we identified 12 cases with silicone-infiltrated neck lymphadenopathies, histologically confirmed by fine needle aspiration. They represented 3.5% of patients attended for neck lymph node study. We removed those detected by physical examination and CT in 5 cases, due to pathological characteristics of the node or a previous malignant history. In 2 of these nodes recurred, and node size also increased in 2 of the other 7 non-operated cases. After implant removal, silicone leakage was observed in only 7 cases.

Conclusions: Cohesive gel silicone used for mammary implants can generate increased neck lymphadenopathies as a secondary effect due to systemic reactions against the silicone when it migrates in cases of implant failure. Surgical options for involved nodes usually do not offer good long-term results.

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Linfadenitis cervical debida a granuloma de silicona tras implantes mamarios

Resumen

Introducción: La reacción a cuerpo extraño producida por silicona donde se infiltra o en los territorios donde migra se conoce como siliconoma. Su empleo en las técnicas de aumento de pecho puede generar esta reacción en niveles cervicales si la cápsula del implante se rompe.


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Métodos: Se han revisado los casos que consultaron por adenopatías cervicales de tamaño elevado en pacientes previamente sometidos a cirugía plástica de mama con geles cohesivos de silicona.

Resultados: En 10 años han sido constatados 12 casos con adenopatías cervicales infiltradas por silicona, confirmados mediante puncción-aspiración con aguja fina. Suponen el 3,5% de todos los pacientes atendidos para estudio de adenopatías cervicales. Fueron retiradas aquellas detectadas por exploración física y TC en 5 casos, bien por presentar características patológicas o por historial previo de malignidad. En dos casos intervenidos los ganglios reaparecieron, mientras que en dos de los 7 pacientes donde se decidió no actuar, el volumen de las adenopatías también aumentó. Tras retirar los implantes, sólo se observaron fugas en 7 casos.

Conclusiones: La silicona empleada en geles cohesivos para implantes mamarios es susceptible de generar como efecto secundario aumento del volumen de los ganglios linfáticos del cuello debido a reacciones sistemáticas frente a la misma cuando migra. Las alternativas quirúrgicas de las adenopatías afectas no suelen ofrecer buenos resultados a largo plazo.

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Introduction

At present, numerous medical and surgical procedures aimed at enhancing the body are as common as untested or even banned due to their secondary effects. In this regard, silicone is a commonly used filling agent, as are autologous fat or non-biocompatible substrates – hyaluronic acid, collagen or hydroxyapatite. The points in favour of the former are its thermostability, sterilisation capacity, viscoelastic stability against chemical compounds and minimal adherence to tissues.

However, the risk of treatment lies in the possibility of causing rejection and migration, which are very common occurrences with liquid silicone. In the case of implants, they occur due to breakage of the implant capsule.

The infiltration of liquid or scarcely cohesive gelled silicone favours local infections in the form of cellulitis and subepidermal abscesses, and in deep tissues generates a redistribution of subcutaneous fat, with disorganisation and remodelling of the adipose panniculus. This lipid restructuring often promotes contact between the infiltrated compound and cells containing antigens, thus activating a wide range of defence mechanisms, from production of foreign body granulomas to delayed hypersensitivity reactions, through aetiopathogenic pathways similar to those of sarcoidosis. This offers a potentially therapeutic application.

Foreign body granulomatous reactions caused by silicone in tissues with a significant fibrosis component have been well-documented and are known as siliconomas. In the absence of anatomical barriers, their movement to neighbouring tissues resulting in deformities is not unusual. Neither is migration to other parts of the body, usually detected by regional lymphatic chains in the axilla, abdominal wall or limbs. Intragenital lesions may extend to several regions in the organism before foci are observed in the infiltration area or signs of implant infection are identified.

The rate of rupture of breast implants is not over 1%, but an increase reaching up to 10%–12% in the first 3 years after implantation has been reported in relation to the use of cohesive gels by a French firm in the past 2 decades.

The damage to health is not due to the toxicity of the gel contents, but rather to the capacity of silicone to induce local defensive reactions and to move within the organism. The latter was the cause of the prohibition of treatment with liquid silicone in increase and enhancement surgeries, and the reason for the suspension of the use of breast implants marketed by the investigated brand, given the possibility of releasing the substance into the body.

Although the lymph node chains initially involved in a reaction to silicone are those closest to the implant, nodal involvement is first detected due to extension at the cervical level. Otolaryngologists should be aware of this possibility. We have carried out a review according to the findings observed in patients using these implants.

Patients and Methods

Through a longitudinal, descriptive and retrospective study, we collected patient data from the computer records of our centre, labelled as diagnoses of cervical lymphadenopathy. A total of 342 subjects were thus identified between January 2002 and January 2012.

The only criteria for inclusion in the series were: undergoing a complete physical examination of the neck and nodal regions accessible to the physician – head, axillae, abdomen, groin –, a cervical ultrasonography imaging study, eco-Doppler ultrasound or computed tomography (CT) scan, and histopathological confirmation by fine needle aspiration (FNA).

Thus, we established a much more specific diagnosis of granulomatous adenitis or siliconoma due to foreign body reaction against silicone. We recorded the chronobiological and anatomical peculiarities of the relevant lymphadenopathies.

Results

Table 1 shows the clinical and topographic data of all lymphadenopathies detected.
Table 1  Clinical, Topographic and Epidemiological Characteristics of the Lymphadenopathies Detected, Along With Attitude Adopted and Evolution.

<table>
<thead>
<tr>
<th>Age, years</th>
<th>Mammaplasty technique</th>
<th>Time between mammaplasty and diagnosis, months</th>
<th>Level</th>
<th>Cervical chain</th>
<th>Number of cervical adenopathies</th>
<th>Maximum diameter, mm</th>
<th>Other chains</th>
<th>Attitude</th>
<th>Evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>Increase</td>
<td>12</td>
<td>iv</td>
<td>Transverse cervical</td>
<td>3</td>
<td>16</td>
<td>Axillary</td>
<td>Expectant</td>
<td>Stabilisation</td>
</tr>
<tr>
<td>33</td>
<td>Increase</td>
<td>18</td>
<td>iv</td>
<td>Transverse cervical</td>
<td>2</td>
<td>22</td>
<td>Mediastinal</td>
<td>Cervicotomy</td>
<td>Reappearance</td>
</tr>
<tr>
<td>44</td>
<td>Increase</td>
<td>10</td>
<td>v</td>
<td>Spinal</td>
<td>1</td>
<td>14</td>
<td>Axillary internal Mammary mediastinal</td>
<td>Expectant</td>
<td>Increase</td>
</tr>
<tr>
<td>30</td>
<td>Reconstruction</td>
<td>8</td>
<td>iv</td>
<td>Transverse cervical</td>
<td>1</td>
<td>18</td>
<td>No</td>
<td>Cervicotomy</td>
<td>Disappearance</td>
</tr>
<tr>
<td>48</td>
<td>Increase</td>
<td>14</td>
<td>vi</td>
<td>Anterior jugular</td>
<td>1</td>
<td>20</td>
<td>No</td>
<td>Expectant</td>
<td>Stabilisation</td>
</tr>
<tr>
<td>38</td>
<td>Increase</td>
<td>24</td>
<td>iv–vi</td>
<td>Internal and anterior jugular</td>
<td>2</td>
<td>15</td>
<td>Axillary Mammary internal</td>
<td>Expectant</td>
<td>Increase</td>
</tr>
<tr>
<td>50</td>
<td>Increase</td>
<td>40</td>
<td>v</td>
<td>Spinal</td>
<td>3</td>
<td>24</td>
<td>Axillary</td>
<td>Cervicotomy</td>
<td>Disappearance</td>
</tr>
<tr>
<td>33</td>
<td>Increase</td>
<td>60</td>
<td>v</td>
<td>Transverse cervical</td>
<td>1</td>
<td>13</td>
<td>No</td>
<td>Expectant</td>
<td>Disappearance</td>
</tr>
<tr>
<td>46</td>
<td>Increase</td>
<td>22</td>
<td>iv</td>
<td>Transverse cervical</td>
<td>&gt;3</td>
<td>19</td>
<td>Axillary internal Mammary mediastinal paraaortic</td>
<td>Cervicotomy</td>
<td>Disappearance</td>
</tr>
<tr>
<td>54</td>
<td>Reconstruction</td>
<td>36</td>
<td>iii–iv</td>
<td>Internal jugular</td>
<td>2</td>
<td>17</td>
<td>No</td>
<td>Cervicotomy</td>
<td>Reappearance (reintervention)</td>
</tr>
<tr>
<td>33</td>
<td>Increase</td>
<td>70</td>
<td>iv</td>
<td>Transverse cervical</td>
<td>1</td>
<td>23</td>
<td>Axillary</td>
<td>Expectant</td>
<td>Stabilisation</td>
</tr>
<tr>
<td>29</td>
<td>Increase</td>
<td>20</td>
<td>iv</td>
<td>Transverse cervical</td>
<td>1</td>
<td>15</td>
<td>Axillary mediastinal</td>
<td>Expectant</td>
<td>Disappearance</td>
</tr>
</tbody>
</table>
A total of 12 cases with significant cervical lymphadenopathies secondary to silicone infiltration were identified in the studied time period – 3.5% of all patients with a primary diagnosis of "studied adenopathy". The 12 patients were all females aged between 29 and 54 years (mean: 39.9±8.4 years) who had previously undergone plastic surgery for implantation of breast augmentation – for cosmetic purposes, or reconstruction – after mastectomy due to malignancy, with a time interval ranging between 8 and 70 months (mean: 40.6±8.1 months) between surgery and the onset of lymphadenopathy.

The report of the FNA conducted showed haematological and lymphoid extension with abundant, optically empty, globoid material, compatible with prosthetic material and multinucleated giant cellularity phagocytising said foreign material by intracellular vacuolisation (Fig. 1).

In all cases, the location of the affected lymphadenopathies was in caudal cervical segments, at levels IV–VI, with a maximum adenopathy diameter varying between 13 and 24 mm. In 50% of cases, cervical lymphadenopathies detected by physical examination and imaging techniques were unique, whilst in 25% of cases, 3 or more were observed in the same patient. The most frequently involved cervical lymph node chain was the transverse cervical, with 7 cases (Fig. 2). In addition, CT studies also detected a significant increase of non-cervical lymphadenopathies in 8 patients, mainly axillary.

The attitude adopted in these adenomegalias was conservative in 7 cases, whilst in the remaining 5 cases the decision was to carry out excision by cervicotomy and obtain intraoperative biopsies, depending on the pathological volume of the nodules observed or the prior neoplastic history.

The histopathological image in the lymphadenopathies obtained surgically was repetitive: large silicone vesicles interposed between activated lymphocytes, interfollicular plasma cells and multinucleated giant cells (Fig. 3). Malignancy was ruled out in all cases.

Regarding the attitude adopted, stabilisation of the lesion or disappearance thereof upon physical examination was observed in 9 patients. Of the 3 cases in which persistence of lymphadenopathic growth was observed, only 1 case underwent a new nodal excision surgery due to the prior neoplastic history of the patient.

Removal of breast implants was conducted in all 12 patients studied by the Department of Plastic and Reconstructive Surgery. An MRI study detected only 1 case of prosthesis breakage, whilst microscopic silicone leaks were identified in another 6 cases after their postoperative manipulation.

**Discussion**

Liquid silicone was used for years in cosmetic medicine as a permanent, non-carcinogenic, filler substance, without risk of bacterial growth and stable viscosity. However, its use was banned in the United States in 1965, due to the continued occurrence of side effects including foreign body granuloma, cellulitis, ulcers, skin necrosis and even hepatitis and

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**Figure 1** Fine needle aspiration (FNA) of an infiltrated lymphadenopathy with giant multinucleated cellularity phagocytising foreign material compatible with prosthetic material (Papanicolaou stain, 400×).

**Figure 2** Axial CT section showing lymphadenopathies in the left, transverse cervical chain, up to 15 mm in size.

**Figure 3** Histopathological image of a lymphadenopathy where the silicone is identified by an absence of staining of intercellular vacuoles (May–Grünwald–Giemsa stain, 100×).
pneumonitis, especially in immunocompromised patients. In Spain, an exaggerated abnormal medical practice and ignorance by patients have allowed the continuation of these techniques.

However, silicone or polydimethylsiloxane (PDMS) – a synthetic polymer based on silicon, oxygen and methane – is also used for medical applications, as a solid in prostheses and as a cohesive gel, especially for breast implants.

In the latter case, the European company mentioned earlier was reported in 2010 in relation to the occurrence of post-implantation breast cancer. Additionally, the potential to detect subjects at risk of systemic silicone migration has increased.

Cervical lymphadenopathies infiltrated by silicone are often undervalued by physicians and patients, as they do not offer signs of other growths. Omakobia et al. have recently pointed to breast implants as a causal factor in the neck region. The high number of procedures for the enlarge-ment of breasts with implants, which carry an unaffordable incidence of breakage, promote this collateral effect.

The first lymphadenopathies involved in this defence reaction against foreign substances cause adenomegalias, which are often subclinical, in auxillary and internal mammary chains. However, based on the classical cervical topography, there are 2 fundamental nodal groups comprised by the anterior and lateral cervical chains of the neck. The latter is, undoubtedly, the most significant due to the number of constituent nodes and because it represents the principal cephalic lymphatic efferent, as well as retrograde from the thorax. The deep lateral nodes are systematized in the triangle of Rouvière in the internal jugular, spinal and transverse cervical chains. This explains the potential for head and neck neoplasms to generate intrathoracic metastases, as well as the possibility that an auxillary, nodal, granulomatous reaction by mammary inflammation directly causes supraclavicular adenopathies. Consistent with this, Aktouf et al. reported an incidence of 8% distant extension to the breast and axilla in a series of women who had been implanted with PIP model prostheses. This would ultimately justify why, in our review, the most commonly detected nodules after breast implantation were the lower levels of the internal jugular and transverse cervical chains.

Cervical adenitis should be studied by FNA cytology. This test is harmless and effective, as the presence of multinucleated giant cells and especially the visualisation of silicone vacuoles in intranodular histiocytes are a highly reliable sign of the condition.

The imaging technique of choice is CT, as it can identify the number, shape, size and location of lymphadenopathies in the chest and abdomen, which, according to the documented criteria for radiological nodal malignancy, help to guide and complement diagnostic suspicion. Cervical ultrasound imaging shows a characteristic, albeit not definitive, “snowstorm” image, with diffuse hyperechogenicity and posterior reverberation caused by the difference in speed of ultrasounds through the infiltrated tissue. The Doppler test does not provide valid additional information. However, imaging tests are inconclusive and can generate a false suspicion – together with a physical examination – of cervical metastases or lymphoproliferative syndrome. Furthermore, silicone masses can capture fluorodeoxyglucose intensely in PET-CT studies. In the case of patients with reconstructive mammoplasties due to previous neoplasms, as in 2 of our cases, these circumstances require a prudent surgical resection attitude. Although the association of silicone leakage with recurrence of tumour in the breast has not been demonstrated, it does not rule out a potential concomitant recurrence of the disease. A cervicotomy with adnectomy provides abundant material and sufficient for a definitive diagnosis.

From the standpoint of therapeutic efficacy, excision of the siliconoma is not usually definitive unless significant segments of adjacent healthy tissue are also removed. In addition, the number of infiltrated lymphadenopathies cannot be predicted. Thus, the attitude to follow is controversial. As lymphatic circulation has no anatomical barriers, the identification of a cervical lymphadenopathy infiltrated by silicone requires its neighbours to be considered potentially affected. Our results show that in 5 of the 7 cases in which we chose not to act, the lymphadenopathic process stabilised or disappeared spontaneously, whilst for the 5 cases where exploratory cervicotomy was performed, lymphadenopathy recurred in 2 patients. Cawse and Pickford also warned of the recurrence of adenomegaly symptoms after excision of adenitis infiltrated by gel derived from PIP implants.

Except for cases with suspicion of malignancy, given the high number of cases where excision is not satisfactory, the surgical attitude in cases of cervical lymph node growth with confirmed infiltration by silicone should be discussed with the patient. In our opinion, surgical approaches should be restricted to those patients with marked aesthetic alterations, and always after providing adequate information about a potential recurrence of the lesions.

Other documented options, including minocycline, cyclosporine and isotretinoin, have shown partial and transient clinical responses, as well as a considerable array of side effects. Etanercept has provided valid results in skin lesions in direct contact with silicone. Imiquimod, an anti-TNF agent used successfully in sarcoidosis which inhibits the expression of the GLI-1 oncogene, has also shown therapeutic efficacy in cases of systemic nodal progression. CO2 laser can vapourise the granuloma by overcoming the thermal stability of polysiloxane, although not without the risk of devitalising adjacent tissue. Thus, it is more safely indicated for silicone globules in the facial or thoracic surfaces, and can also remove multiple scattered lesions in the same surgical procedure.

In short, we are faced with a new cervical entity. Physicians should be aware of the location, as well as the medical history of each individual. When adequately filiated, the definitive therapeutic option is still a matter for discussion, in terms of the experience of side effects which breast augmentation surgical procedures can cause.

Conflict of Interests

The authors have no conflict of interests to declare.

References

1. Yanagihara M, Fuji T, Wakamatu N, Ishizaki H, Takehara T, Nawate K. Silicone granuloma on the entry points of