

THE EVOLUTION OF SURGICAL TREATMENT OF BREAST CANCER
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The first reference to breast cancer in the history comes from Ancient Egypt and dates from about 1600 years BC. It is recorded in a papyrus discovered by the archaeologist Edwin Smith, in 1862. In this papyrus, which is about 5 meters long, there are notes on several diseases and how they were treated at the time. There is a small reference to what we understand to be breast cancer that says "a breast with a protuberant tumor and cold to the touch represents a disease for which there is no treatment".

From here there are some interesting records about surgery for breast cancer throughout history that worth to mention. Hippocrates, who is considered the Father of Modern Medicine, devoted only a small part of his studies to breast cancer. He considered breast cancer an incurable disease and did not recommend any kind of treatment.

In the first century AC, Leonidas performed what is considered the first surgery for breast cancer.

In the same century, the Roman writer Aurelius Cornelius Celsus, writing about the history of Greek medicine, reported that □the treatment was ineffective when the tumor was ulcerated and that aggressive measures worsened prognosis.

In the second century, Galeno, who was considered the most important greek physician after Hippocrates, said that it was possible to cure breast cancer since the tumor is superficial and all its roots can be excised.

In the tenth century, *Avicena* used to say that surgery was valid only for superficial cases and *Albucassis* admitted that never had one case cured.

In the sixteenth century, Wilhelm Fabry, who is considered the “Father of German Medicine”, invented the first surgical instrument specific to perform mastectomy. The breast was hold in an iron ring and amputated with a kind of knife.

In the 17th century, another German doctor, Johannes Scultetus, who, besides surgeon was also an illustrator of books on surgical technique, invented another instrument specific for mastectomy. Large needles were introduced in the deepest part of the breast and these needles were attached to cords. An assistant pulled the cords while the surgeon cut the breast with a kind of knife. Then he used a hot iron tool to perform hemostasis.

In the 18th century, *Jean Louis Petit*, who was the first Director of the Royal French Academy of Medicine, defended the removal of the breast, pectoralis muscles and axillary limph nodes. This is considered the first tecnique of mastectomy described.

In the same century, the German surgeon Lorenz Heister, invented a type of small guillotine to do the amputation of the breast. He believed that performing a fast procedure, made it less painful for the patient.

In the 19th century with the advent of anesthesia, introduced by Willian Morton, in 1846, and of antisepsis, by Joseph Lister, in 1867, surgery begins to be performed in a more acceptable and human way and, from there, it begins to appear the first real advances in this field.

In 1894, the first major advance on breast cancer surgery: the american surgeon William Stuart Halsted, from Baltimore, described his technique of radical mastectomy. Halsted developed the technique based on his understanding that breast cancer began in the ducts and the malignant cells moved through the lymphatic vessels into axillary lymph nodes and only after reaching these lymph nodes the cells could invade the bloodstream. For this reason, the technique was represented for *en bloc* removal of the breast, overlying skin, both *pectoralis* muscles and axillary lymph nodes. Here the history of breast cancer surgery presents a big coincidence: about 10 days after the publication of Halsted's technique, another american surgeon, Willy Meyer, in New York, publishes a technique almost equal. It is considered a historical coincidence because at that time the communication between them was

impossible in so short time. Although the term Halsted's mastectomy has been established, some authors prefer to call the technique as Halsted-Meyer's mastectomy.

Prior to the popularization of Halsted's radical mastectomy, surgical treatment of breast cancer resulted in extremely high rates of local recurrence and very poor survival. Some of Halsted and Meyer's patients were cured of their disease, so, for the first time, the surgeons had an effective treatment for breast cancer, and radical mastectomy quickly became the standard of surgical treatment for the disease. It is very interesting that this mastectomy technique remained as the standard for breast cancer surgical treatment for almost 80 years.

Studies conducted in the early 20th century showed a significant drop in the number of recurrences and deaths from breast cancer after the adoption of radical mastectomy as the standard for breast cancer treatment. However, mastectomy was not sufficient to solve all cases and a significant number of deaths from the disease continued to be observed. Due to these not so good results, from 1920 it began a new trend: radical mastectomy more extensive than the Halsted-Meyers's technique: Handley proposed in 1927 an extended radical mastectomy that included removal of the lymph nodes of the internal mammary chain. In 1949, Wangenstein proposed the supraradical mastectomy, an

extended mastectomy with dissection of internal mammary and supraclavicular lymph nodes and in the early 50's Jerome Urban, in New York, proposed an extended mastectomy with dissection of internal mammary lymph nodes, *en bloc* with costal cartilages and intercostal muscles. To the disappointment of these surgeons, the increase in radicality of mastectomy did not improve the results in terms of prognosis.

In the late 40's a new trend begins to appear: that of performing less radical surgery. In 1948, Patey showed his results with an alternative technique to Halsted's mastectomy: he performed a radical mastectomy preserving the muscle pectoralis major. Comparing his operation with the standard radical mastectomy, he found no difference in survival or local recurrence rates between the two groups.

Following the less radical trend, Madden and his colleagues presented results of a consecutive series of patients treated by their modified radical mastectomy, in which both the pectoralis major and the pectoralis minor were preserved. Outcomes were similar to those using the radical mastectomy.

In the early 80's emerged what is considered the big revolution in terms of surgery for breast cancer: the conservative treatment. Although modified radical mastectomy represented a less morbid procedure than

radical mastectomy, it still required the loss of the breast. The question arose as if the breast could be preserved without compromising survival.

In the 70's, Bernard Fisher showed evidences that breast cancer could be a systemic disease from the beginning and that distant metastases could be present before diagnosis in most cases. The implication was that extended mastectomies were useless. However, Fisher also showed evidences that debulking the tumor mass might stimulate the body to destroy remnant tumor cells by immunologic and other mechanisms. These ideas stimulated surgeons to begin to experiment breast-conserving treatments for breast cancer.

On the other hand, the success of radiotherapy in eliminating subclinical disease allowed the concept of breast conservation to move forward.

The first major clinical trials investigating breast conservation began in the 70's. The first trial to publish five-year results was that of Veronesi's group in Milan. This trial, known as Milan 1, compared quadrantectomy plus radiotherapy plus axillary dissection with radical mastectomy. 701 patients with T1 tumors and clinically negative axilla were randomized to receive quadrantectomy plus axillary dissection and radiotherapy or modified radical mastectomy. No difference between the two treatments was found.

In 1986, Fisher published five-year results of his trial comparing lumpectomy with total mastectomy showing no difference in terms of overall survival.

Twenty-year follow-up of both these landmark studies confirmed that conservative breast surgery is equivalent to mastectomy as a treatment for breast cancer. From here, many other trials validated conservative treatment.

This was an important advance, as the mutilation from mastectomy was considerably reduced by the conservative approach.

In 1985, Veronesi's group published the trial Milan II, that compared quadrantectomy (QUART) with tumorectomy (TART), the two techniques followed by axillary dissection and radiotherapy. The trial concluded that:

- □QUART technique is superior to TART when the parameter considered is the local recurrence rate.
- TART has a better aesthetic result.
- Overall survival does not differ in both forms of treatment.

To Veronesi and his group it remained an issue to be clarified: radiotherapy was really essential? Milan 3 trial compared the results of quadrantectomy with or without radiotherapy and showed that local recurrence rate was significantly higher in the group that did not receive

radioterapy.

Today the standard of care for patients with stage I/II breast cancer is lumpectomy or a more extended resection like quadrantectomy, followed by whole breast irradiation. However, for more advanced disease, and a number of other indications, such as *in situ* neoplasia not amenable to breast-conserving surgery, big tumors or local recurrence after breast conserving surgery, mastectomy is necessary. At the same time, the mastectomy operation continues to undergo modifications following the trend to be less extensive but oncologically adequate.

The concept of skin-sparing mastectomy was introduced in 1991. The operation consists of breast gland removal, removal of the nipple-areola complex, biopsy scar, and skin overlying the cancer, with preservation of remaining skin and inframammary fold. This tecniques maximizes skin preservation and facilitates breast reconstruction, whose aesthetic outcome depends considerably on the quantity of breast skin remaining. The benefits of skin-sparing mastectomy are that it reduces postmastectomy deformity, allows better breast shape after reconstruction, minimizes residual scarring, and reduces the area of skin necessary on myocutaneous flaps. Despite concerns regarding local control, the data available in literature do not show an increased risk of local recurrences when skin-sparing

mastectomy is compared with traditional modified radical mastectomy.

Nipple-sparing mastectomy is a refinement of skin-sparing mastectomy in which the nipple-areolar complex is preserved. Its aim is also to improve the aesthetic results of the reconstruction, which is usually performed immediately. It is mostly indicated to peripheral tumors. In tumors of central quadrant the nipple-sparing mastectomy is contra-indicated.

Even when traditional radical mastectomy is performed, it is possible to reconstruct the breast. Breast reconstruction is nowadays a very common procedure and should be offered to all women whose have to loose their breast in order to treat a breast cancer. The breast reconstruction can be performed in almost all cases of mastectomy. The exceptions are the very elderly patients or those without clinical condition for the surgery.

In the very end of 20th century, following the trend to a more conservative approach, emerged a new possibility: that of not perform axillary dissection for negative-node patients, by the identification of the main lymph node of the chain, the sentinel lymph node. The concept of sentinel lymph node is nowadays widely accepted. Axillary dissection was always considered an important step in the surgical treatment of breast cancer, mainly because the status of lymph nodes is

the main prognostic factor for the disease. The sentinel node biopsy can avoid axillary dissection in a significant number of patients, especially in the early stages of breast cancer. Considering that the axillary dissection is the step of breast cancer surgery of most morbidity, it is not acceptable today to not offer, especially for patients of early breast cancer, the sentinel lymph node technique. The sentinel lymph node technique is based upon the observation that tumor cells migrating from a primary tumor metastasize to one or a few lymph nodes before involving other nodes.

The conclusion from a paper by Stefano Zurrada and colleagues, reflects what we can expect for the near future:

“There is no sign yet that surgery for breast cancer will be supplanted by noninvasive treatments, so the way forward seems to be the development of increasingly sophisticated surgical procedures that are ever more precisely tailored to the individual patient and typically require the skills of an oncoplastic surgeon as well as the breast surgeon and multidisciplinary team.”

